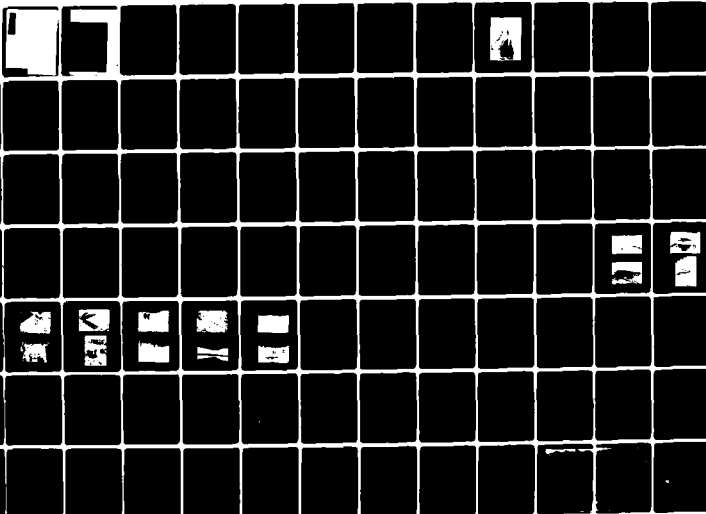


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NATIONAL DAM INSPECTION PROGRAM. STAR JUNCTION NUMBER 1 DAM (NO-ETC(U)
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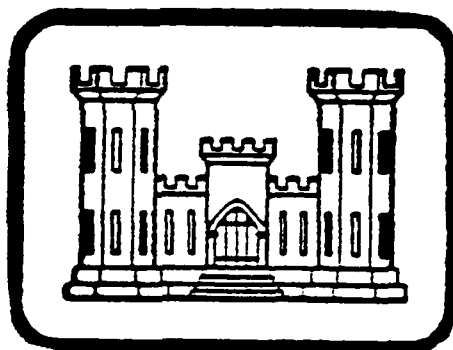
⑥ National Dam Inspection Program
Star Junction Number 1 Dam
(NDI Number PA-00198, PennDER
Number 26-30) Ohio River Basin,
Washington Run, Fayette County, Pennsylvania.

Phase I Inspection Report

STAR JUNCTION NO. 1 DAM
FAYETTE COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI NO. PA 00198
PennDER NO. 26-30

⑩ WILLIAM/McCORMICK

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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⑮ DACW31-80-C-0426
Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC.
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Pittsburgh, Pennsylvania 15216

Date: ⑪ April 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, materials testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some time in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be improved.

Phase I investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" (PMF) for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS

NAME OF DAM: Star Junction No. 1
STATE LOCATION: Pennsylvania
COUNTY LOCATION: Fayette
STREAM: Unnamed tributary of
Washington Run, a tributary
of the Youghiogheny River.
DATE OF INSPECTION: 7 November 1979
COORDINATES: Lat. 40°03'33",
Long. 79°45'28"

ASSESSMENT

Dam: Star Junction No. 1 dam consists of an earthfill embankment and masonry spillway on the right abutment. The dam has a crest length of 545 feet, a maximum height of 35 feet and a storage volume of 149.3 acre-feet at the spillway crest level. The dam is classified by Corps of Engineers guidelines to be a "small" size, "high" hazard structure.)

Evaluation: Based on the visual observations and the data available, the dam is categorized as being in an "unsafe, non-emergency" condition.)

Owner: The dam and reservoir are owned by Mr. William McCormick of Bentleyville, Pennsylvania.

Embankment: The visual inspection and a review of the available data indicate the embankment to be in poor condition. The inspection revealed the existance of seepage, slope non-uniformities, crest sag, and embankment toe and adjacent downstream soft conditions which may have reduced the structural integrity of the embankment to an unacceptable level.

Outlet Works: The reported outlet works facilities could not be inspected and no indication was found of upstream flow controls.

Spillway: The visual inspection revealed that the masonry spillway on the right abutment has deteriorated to the extent that its structural integrity during extended, large discharge conditions, is questionable. <

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS (CONT'D)
Star Junction No. 1 Dam

Reservoir/Spillway Capacity: Hydrologic/hydraulic computations performed in accordance with criteria established by the Baltimore District, U. S. Army Corps of Engineers, for Phase I inspections indicated that the spillway will pass only 0.18 PMF without overtopping the dam. For a "small" size, "high" hazard structure the Corps recommends a Spillway Design Flood (SDF) of 0.5 to 1 PMF. Because of downstream conditions, the SDF for Star Junction No. 1 dam is the PMF. A dam breach analysis indicated that if an assumed dam failure would occur, downstream flooding would be significantly increased. Consequently, the spillway is rated "seriously inadequate".

RECOMMENDATIONS

1. Additional Investigations. It is recommended that the owner immediately retain the services of a registered professional engineer knowledgeable and experienced in the design and construction of earth dams and masonry spillways to provide a detailed engineering investigation of Star Junction No. 1 dam. This investigation should include but not be limited to the following:

(a) Detailed investigation of the seepage and wet conditions and structural stability of the embankment.

(b) Detailed evaluation of spillway capacity and stability and development of recommendations for remedial action to make the spillway capacity adequate.

(c) Investigation of the outlet works with specific recommendations on making them operable and including provisions for upstream flow controls.

2. Emergency Operation and Warning Plan. Concurrent with the additional investigations recommended above, the owner should develop an Emergency Operation and Warning Plan including:

(a) Guidelines for evaluating inflow during periods of heavy precipitation or runoff.

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS (CONT'D)
Star Junction No. 1 Dam

(b) Procedures for around the clock surveillance during periods of heavy precipitation or runoff.

(c) Procedures for rapid drawdown of the reservoir under emergency conditions.

(d) Procedures for notifying downstream residents and public officials, in case evacuation of downstream areas is necessary.

3. Remedial Work. The Phase I Inspection of Star Junction No. 1 dam also disclosed several deficiencies of lower priority which should be corrected immediately.

(a) Closely mow the embankment slopes, crest, groins, abutments and immediate downstream areas. Remove the cuttings from the site.

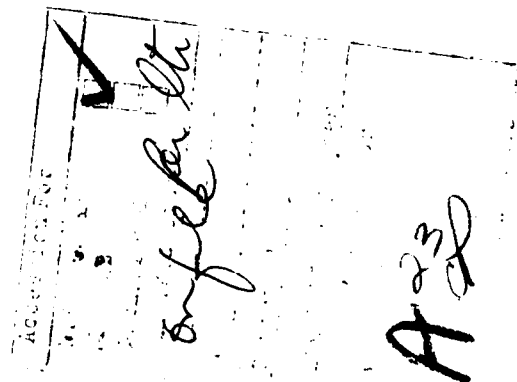
(b) Locate and backfill completely, all animal burrows on the embankment, groins and adjacent abutment areas.

(c) Replace lost riprap along the upstream slope of the embankment.

(d) Fill wheel ruts and minor erosion gullies on the embankment and adjacent areas.

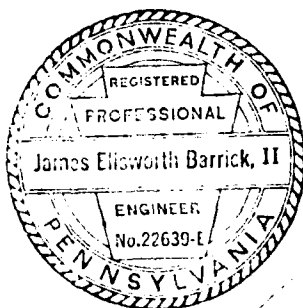
(e) Develop and implement formal maintenance and inspection procedures.

Vehicles should not be permitted on the crest of the embankment until the additional investigations have shown that crest traffic is acceptable. Also, the embankment crest should not be raised at least until completion of the additional investigations.



SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS (CONT'D)
Star Junction No. 1 Dam

4. Orderly Breaching: In lieu of performing the above recommendations, the owner should engage the services of a professional engineer, knowledgeable in dam design and performance, to prepare specifications for breaching the structure, to make it incapable of impounding water. The structure should then be breached under the direction of the professional engineer and in accordance with applicable state and local regulations.



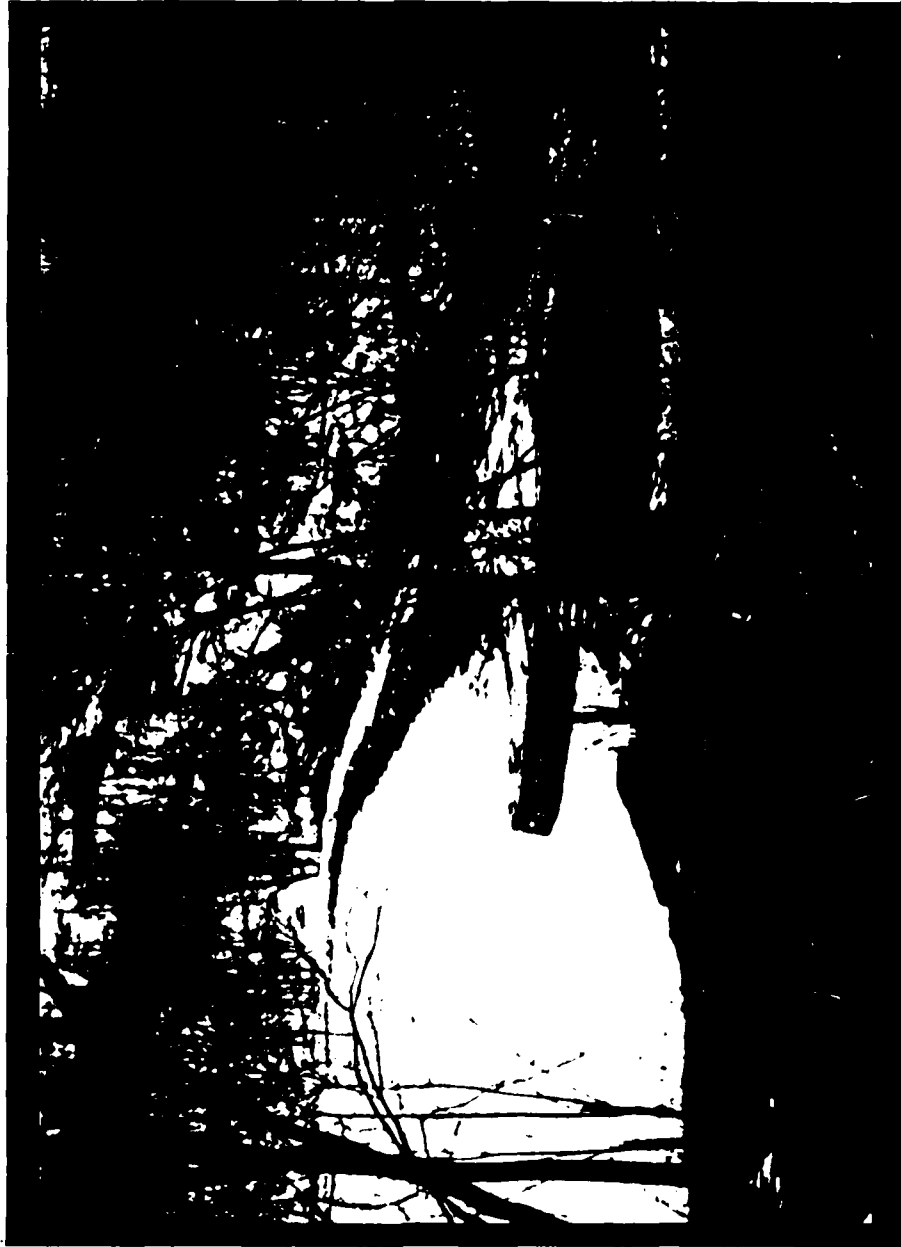
James P. Hannan 18 April 1980
James P. Hannan Date
Project Engineer

James E. Barrick 18 April 1980
James E. Barrick, P.E. Date
PA Registration No. 022639-E

Approved by:

James W. Peck 9 May 1980
JAMES W. PECK Date
Colonel, Corps of Engineers
District Engineer

STAR JUNCTION No. 1 DAM



OVERVIEW

TABLE OF CONTENTS

	<u>Page</u>
PREFACE	i
SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS	ii
OVERVIEW PHOTOGRAPH	vi
SECTION 1 - PROJECT INFORMATION	
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	3
SECTION 2 - ENGINEERING DATA	
2.1 Design	5
2.2 Construction	5
2.3 Modification/Repair	5
2.4 Operation	5
2.5 Evaluation	6
SECTION 3 - VISUAL INSPECTION	
3.1 Findings	7
3.2 Evaluation	12
SECTION 4 - OPERATIONAL FEATURES	
4.1 Procedure	14
4.2 Maintenance of Dam	14
4.3 Maintenance of Operating Facilities	14
4.4 Warning System	14
4.5 Evaluation	14
SECTION 5 - HYDROLOGY AND HYDRAULICS	
5.1 Evaluation of Features	15
SECTION 6 - STRUCTURAL STABILITY	
6.1 Available Information	18
6.2 Evaluation	18

TABLE OF CONTENTS (cont'd)

	<u>Page</u>
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS	
7.1 Assessment	20
7.2 Recommendations.	21
APPENDIX A - VISUAL INSPECTION CHECKLIST	
Visual Observations Checklist I	A1
Field Plan	A9
Field Profile	A10
Field Section	A11
APPENDIX B - ENGINEERING DATA CHECKLIST	B1
APPENDIX C - PHOTOGRAPHS	
Photo Key Map	C1
Photos 1 through 18	C2
Detailed Photo Descriptions	C11
APPENDIX D - HYDROLOGY AND HYDRAULICS ANALYSES	
Methodology	D1
Engineering Data	D3
HEC-1 Data Base	D4
Stage-Discharge Relationship	D5
Loss Rate and Base Flow Parameters	D7
Elevation-Area-Capacity Relationship	D7
Overtop Parameters	D9
Program Schedule	D9
Breach Parameters	D10
Channel Routing Parameters	D10
Damage Station Map	D11
HEC-1 Computer Analysis	D12
Reservoir/Spillway Hydrologic	
Performance Plot	D26
APPENDIX E - PLATES	
List of Plates	E1
Plates I through IV	E2
APPENDIX F - GEOLOGY	
Geomorphology	F1
Structure	F1
Stratigraphy	F1
Geologic Map	F3
Geologic Column	F4

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
STAR JUNCTION NO. 1 DAM
NATIONAL I. D. NO. PA 00198
PennDER NO. 26-30

SECTION 1
PROJECT INFORMATION

1.1 GENERAL

a. Authority: The Phase I investigation was performed pursuant to authority granted by Public Law 92-367 (National Dam Inspection Act) to the Secretary of the Army through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose: The purpose of the investigation is to determine whether or not the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Dam and Appurtenances: The dam consists of an earth embankment and a masonry spillway located on the right abutment.

(1) Embankment: The embankment is constructed of earth founded on clay and is 475 feet long (excluding spillway), a maximum 35 feet high, and has a crest width that varies from 12 to 20 feet. The upstream slope is 2H:1V and the downstream slope is 2.5H:1V except near the lower left end of the embankment.

(2) Outlet Works: Available design and construction information indicates that two 8 inch cast iron water supply pipes were constructed through the embankment.

(3) Spillway: The principal spillway consists of a masonry weir wall located between the right abutment and the right end of the embankment. The weir wall lies between a training wall on the left and a wingwall on the right, has a trapezoidal cross-section with a base 24.5 feet long. The overflow crest is four feet wide and lies at Elev. 1046.5 (MSL). Normal base flows and flood flows are discharged through this spillway.

(4) Flood Plain Development: At least thirteen inhabited dwellings lie on the flood plain in the first 2000 feet below the dam. In the first two

miles below the dam, the flood plain contains State Route 51, a major north-south highway, the village of Star Junction and the Borough of Perryopolis.

(5) Reservoir: Star Junction No. 1 dam impounds a reservoir with a normal length of 1150 feet and normal surface area of 11.9 acres. When the pool is at the crest of the dam, the reservoir length is 1200 feet and the surface area is 13 acres.

(6) Upstream Dam: Star Junction No. 2 dam lies immediately upstream of Star Junction No. 1 dam such that the lower toe of the No. 2 dam embankment is submerged by the normal pool of No. 1 dam. No. 2 dam principal spillway discharges directly to the No. 1 dam reservoir.

b. Location: Star Junction No. 1 dam is located 0.25 mile east of Star Junction, Perry Township, Fayette County, Pennsylvania. The dam is situated on an unnamed tributary of Washington Run, which flows into the Youghiogheny River near Layton, Pennsylvania.

c. Size Classification: This dam has a storage capacity of 189 acre-feet at the embankment crest and a maximum toe to crest height of 35 feet. Based on this data, the dam is classified as a "small" size structure.

d. Hazard Classification: Star Junction No. 1 dam is classified as a "high" hazard dam. In the event of a dam failure, numerous inhabited dwellings and considerable commercial development on the floodplain below the dam would be subjected to substantial damage and loss of life could result.

e. Ownership: Star Junction No. 1 dam is owned by Mr. William McCormick. Correspondence can be addressed to Mr. William McCormick, Box 998, Bentleyville, Pennsylvania 15314 (412-239-4433).

f. Purpose of Dam: Star Junction No. 1 dam served to impound water for domestic use in Star Junction until July 1979; its current use is unknown. It was originally constructed to supply water for industrial use by the Washington Coal and Coke Company.

g. Design and Construction History: Star Junction No. 1 dam was constructed by E. J. Taylor of the Washington Coal and Coke Company in 1892. Between 1901 and 1936 several modifications were made to the structure.

(1) The height of the embankment was increased in 1901, 1902, 1903, and 1904 for a total of 11.4 feet.

(2) In 1917, a concrete wall was constructed against the downstream face of the spillway's weir wall to provide reinforcement. The repairs were made because of a blow out at the weir wall's foundation.

(3) In 1920, a portion of the upstream slope was strengthened and re-shaped by placing fill material and stone on the slope and an 8.5 foot high concrete cutoff wall was constructed along the entire length of the upstream slope to a depth of four feet into the existing embankment slope. The top of the wall was 18 feet below the crest of the dam. The wall was constructed to control seepage on the downstream slope that had caused a 200 foot long landslide in December 1919. Fill was added to the downstream slope for stabilization and the old spillway weir was removed and replaced with a concrete wall of the same height.

(4) In 1936, the owner was instructed to raise the crest to design elevation when it was observed to be low on the left side of the embankment.

1.3 PERTINENT DATA

a.	<u>Drainage Area:</u>	1.18 sq. miles
b.	<u>Discharge at Dam Facility:</u>	
	Maximum Known Spillway Flood	
	June 4, 1941	620 cfs*
	Spillway Capacity at	
	Top of Dam	541 cfs
c.	<u>Elevation:</u> (Feet above MSL).	
	Current Top of Dam (low point)	1049.8
	Normal Pool	1046.5
	Spillway Overflow Crest	1046.5
	Maximum Tailwater	Unknown
	Inlet Invert of Water Supply	
	Pipelines	Unknown
	Streambed at Toe of Dam	Not applicable
	Base of Embankment	1015.0*

Outlet Invert of Water Supply Pipelines	Unknown
--	---------

d. Reservoir Length:

Length of Maximum Pool	1200 feet
Length of Normal Pool	1150 feet

e. Reservoir Storage:

Current Top of Dam	189 acre-feet
Spillway Crest	149.3 acre-feet*
Normal Pool	149.3 acre-feet*

f. Reservoir Surface:

Current Top of Dam	13 acres
Spillway Crest	11.9 acres*

g. Embankment:

Type	Earth
Length	475 feet
Height	35 feet
Slopes:	
Downstream	2.5H:1V
Upstream	2H:1V*
Minimum Crest Width	12 feet

h. Outlet Works: (Two reported)

Type	8 in. cast iron pipe*
Inlet	Unknown
Conduit Length	Unknown
Gate Valves	Downstream
Anti-Seep Collars	Unknown

i. Principal (Ungated) Spillway:
(Regulating and Emergency Outlet)

Type	Masonry and Concrete weir wall with training wall (embankment side) and wing wall (abutment side)
Cross Section	Trapezoidal
Weir Crest Length	24.5 feet
Weir Crest Elevation	1046.5 feet*
Total Length including Abutment Wing Wall	68 feet
Gate or Control	None

*Taken from available engineering data in PennDER files.

SECTION 2 ENGINEERING DATA

2.1 DESIGN

The files of the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER) were reviewed but no engineering data related to the original design of the embankment and spillway were found. The owner could provide no data on this dam.

2.2 CONSTRUCTION

No information was found related to the original construction of this dam.

2.3 MODIFICATION/REPAIR

PennDER files indicated that several modifications were made to the structure during its 88 year history. These modifications included raising the height of the structure in 1901, 1902, 1903 and 1904 (a total of 11.4 feet). In 1917, modifications were made to the spillway which included repair of the weir wall. In 1920, major repairs were undertaken to correct a slide failure on the downstream slope. These repairs included flattening the downstream slope, installation of a concrete cutoff wall, paving the upper portion of the upstream slope with riprap, and replacement of the weir wall in the spillway. Repairs performed in 1936 consisted of raising the height of the dam to the height of the spillway training wall because the crest of the dam was found to be about six inches low.

In recent times, fill may have been placed on the embankment crest and stone replaced in the spillway training wall. Concrete block steps have also been added to weir's overflow crest, reducing its discharge capacity.

2.4 OPERATION

The dam was designed to operate without a dam tender, and no operational data is available. The water supply facility, when operating, required periodic attention for both operation and maintenance. No records of such operation and maintenance were available.

2.5 EVALUATION

a. Availability: Engineering data was provided by PennDER, Bureau of Dams and Waterways Management.

b. Adequacy: The available engineering information, though greatly limited, was supplemented by field inspections and supporting engineering analyses and is considered adequate for the purpose of this Phase I inspection report.

c. Validity: Based on the review of the available information, there appears to be no reason to question the validity of the limited engineering data.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

a. General: The initial visual observations of Star Junction No. 1 dam and reservoir were performed on 7 November 1979, and consisted of:

- (1) Visual observations of the embankment crest and slopes, groins, and abutments;
- (2) Visual observations of the spillway including weir wall, wingwall, training wall and dike, and approach and discharge channels.
- (3) Visual observations of the embankment's downstream toe area including drainage swales, abandoned structures, springs, and wet areas.
- (4) Visual observations of downstream conditions and evaluation of the downstream hazard potential.
- (5) Visual observations of the reservoir shoreline, inlet stream channels and watershed.
- (6) Transit stadia survey of relative elevations along the embankment crest centerline and spillway.

The visual observations were made during periods when the reservoir and tailwater were at normal operating levels.

Supplemental observations were performed on 1 February 1980 to:

- (7) Review locations of water supply facility gate valves.
- (8) Examine spillway discharge channel downstream conditions.
- (9) Obtain additional photographs for report presentation.

The visual observations checklist, field plan, profile and section, containing the observations and comments of the field inspection team are contained in Appendix A.

Specific observations are illustrated on photographs in Appendix C. Detailed findings of the visual inspection are presented in the following sections.

b. Embankment:

(1) Crest and Upstream Slope: On the date of inspection, the embankment crest had considerable barren earth and there were indications that an earth cap had been placed recently (within the past few years). Wheel ruts with standing water were observed on the left central position of the crest and a few small cracks (probably from drying) were noted. Also, a minor tension crack was seen in the bare earth material along the upstream slope near the spillway training wall. The upstream slope was generally covered with grass and small weeds although barren spots were observed. A trace of riprap was also noted.

The embankment crest appeared to slope gradually toward the left abutment. This observation was confirmed by the stadia survey, which showed a low spot near the left end of the embankment about 0.5 feet lower than the top of the spillway training wall and about one foot lower than the crest's high point near the spillway training wall.

The crest's horizontal alignment was generally straight through the central portion of the embankment, but curved slightly toward the upstream at each end of the embankment.

(2) Downstream Slope: The embankment's downstream slope was entirely covered with a very dense growth of weeds and brush making a general observation impossible. Several brush piles containing recent tree cutting debris were located on the slopes, further hindering the inspection. Consequently, six inspection paths were hand cleared down the slope at 50 foot intervals along the crest to obtain intermittent slope condition information. The slope was found to be reasonably uniform over the right half of the embankment. The soil covering was generally firm (as indicated by finger penetration) though it softened toward the toe. No wet or seeping conditions were observed anywhere on the slope. Two animal burrows were observed approximately at the location shown on the Field Plan. Diggings from the burrows created small bulges on the slope at this location.

On the left portion of the embankment, a terrace was observed containing a foot path that ran from the toe to the crest. The lower portion of the slope was somewhat softer here than on the right, although no seeps or marshy conditions were noted. The slope appeared to be flatter below the path than above.

No sloughing, erosion, or sinkholes were observed along the inspection paths.

c. Groins: No erosion or seeping water was observed in or along either groin (junction of embankment and abutment). However, seeping water was noted beneath the spillway training dike retaining wall for a distance of 18 feet below the weir wall.

The earthen dike behind the retaining wall was brush and tree covered and had begun to erode at locations where the wall was collapsing. Otherwise, there was no observed indication of seepage or instability on the embankment side of the dike.

d. Abutments:

(1) Left: The left abutment is the original valley wall (hillside) and was heavily tree and brush covered at the time of the inspection. There were no observed indications of seepage or instability on the abutment but springs were observed at the toe of the slope. These are discussed in paragraph 3.1h(1) below.

A significant erosional cavity was observed in the hillside about 100 feet downstream of the embankment crest. A nine-inch (inside) diameter cast iron pipe was protruding from the side of the cavity. The pipe was discharging a small amount (trickle) of water into the cavity.

An access road traverses the left abutment from the embankment crest to a point on the valley floor approximately 400 feet downstream of the dam.

(2) Right: The right abutment comprised the right spillway bank and consisted of natural ground which was wooded and brush covered. There were no observed indications of abutment distress outside of normal creek bank erosion.

e. Outlet Works: Four gate valve pits were observed at the locations shown on the Field Plan in Appendix A. The three visible valves were not activated. Several water supply pipe lines were observed inside and adjacent to the outside of the ruined concrete block structure. No pipe leakage was observed.

f. Principal (Ungated) Spillway:

(1) General Configuration: The principal spillway for Star Junction No. 1 dam is an ungated, free overfall weir structure with an embankment side training wall and a wingwall on the abutment side. The spillway is located on the right abutment of the dam. The discharge channel is contained by the natural ground abutment on the right and an earthen training dike and masonry retaining wall on the left.

(2) Approach Channel: The approach channel was unobstructed and of sufficient size to permit unrestricted flow over the weir crest.

(3) Weir: A masonry and concrete weir wall controls the reservoir pool level and provides for normal and storm outflows. It consists of a concrete slab apparently constructed on bedrock, upon which a masonry wall has been constructed. The wall and appurtenant wingwall extend into the right abutment 68 feet. On the left, the weir wall connects to a masonry training wall. A concrete cap and concrete block steps have been added to the weir wall. The slab, walls and cap were in generally poor condition from severe scaling, cracking, spalling, and disintegration. Leaks through and beneath the walls were observed.

(4) Discharge Channel: The discharge channel below the weir wall was generally straight for about 150 feet, but had a very uneven, natural rock bottom. The channel was partially clogged by small trees and debris particularly on the right where the channel side slope is cut into original ground. The approximate slope of the channel bottom in this initial reach was 0.053 feet/foot (5.3%). Below, the channel dropped more steeply and turned sharply to the left before rejoining the original creek channel near the center of the floodplain below the dam.

The left side of the discharge channel consisted of the masonry retaining wall that protects the earthen training dike from erosion. The wall has some undercutting and was observed to have many open joints. The wall has collapsed at a point near its downstream end and erosion of the training dike has occurred.

g. Instrumentation: No instrumentation was observed during the inspection.

h. Downstream Conditions:

(1) Toe Area: The valley bottom in the area immediately below the toe of the embankment was generally wet; standing and flowing water were observed at several locations. In particular, three springs were noted at approximately the locations shown on the Field Plan in Appendix A. The up-valley spring, denoted A, was discharging an estimated 5 gallons per minute while the down-valley springs, denoted B and C, were discharging an estimated 1 gpm and 2 gpm, respectively. The total estimated seepage in the toe drainage channel at its confluence with the creek was 12 to 15 gpm. The flow was clear, and did not appear to be carrying sediments or soil fines. No sinkholes were observed and no unusual sediment deposits were visible.

The area surrounding the springs was observed to be generally soft and wet.

On the right side of the embankment, a drainage swale parallel to the embankment toe, was discharging water although no particular source of seepage or runoff was evident. A small pond, about 1 foot deep was observed in the swale just downstream of the water storage tank. A concrete block lined pit just to the left of the block building ruins was water filled to the ground line but was not discharging any flow.

(2) Downstream Channel: At least thirteen inhabited dwellings lie on the flood plain in the first 2000 feet below Star Junction No. 1 dam. At about 3000 feet below the dam, the creek joins Washington Run and parallels Pennsylvania State Route 51, a major north-south highway. About 1.6 miles downstream, Washington Run turns 90° to the east, and passes through the Borough of Perryopolis.

1. Reservoir.

(1) Shoreline: The reservoir shoreline was moderately to densely tree covered and was observed to range from moderately steep on the left to flat on the right. Minor bank erosion had occurred on the left.

(2) Inlet Streams. Two principal streams enter the upper end of the reservoir. One is a natural drainage course which enters from the northeast through a narrow but flat bottomed valley. The stream channel is winding, and is brush and tree lined. At the reservoir, deltaic development has occurred in the past but has stabilized and is now brush and tree covered.

The second stream entering the reservoir is the discharge channel from the principal (ungated) spillway of Star Junction No. 2 dam. The channel is about 25 feet wide and is badly deteriorated and overgrown with trees and brush.

(3) Upstream Structures: Star Junction No. 2 dam lies immediately upstream of Star Junction No. 1 dam, such that the toe of No. 2 dam is inundated by the No. 1 dam's normal pool. Star Junction No. 2 dam was estimated to be 30 feet high, 340 feet wide (cross-valley) and had a crest width of 14 feet. Star Junction No. 2 reservoir is 700 feet long at normal pool level.

(4) Watershed Conditions: The watershed contributing to Star Junction No. 1 dam was observed to be relatively steep, consisting primarily of pasture and woodland. No active or abandoned mining facilities or major construction sites were observed in the watershed.

3.2 EVALUATION

a. Embankment. The general, overall condition of the embankment is assessed to be poor, based on limited field observations.

Dense brush and weeds made it impossible to perform a close observation of all portions of the downstream slope. However, no scarps or local bulges (excepting animal diggings) were observed.

Of some concern was the change in slope of the embankment's left toe area below the path. Flattening of the slope near the toe, resulting in a non-uniform cross-section, may be an indication of long-term movement (creep) of the embankment.

Although no scarps or cracks were observed in the slope, a careful examination was not possible because of the dense vegetal cover and brush piles.

b. Downstream Toe Area. The springs near the left abutment and the generally marshy and wet conditions of the entire downstream area suggest a possible, significant foundation seepage condition. It is noteworthy that the large marsh area between the block building ruins and the left abutment contains major springs and lies immediately downstream of the possible embankment distress area.

c. Outlet Works. Visual observations were insufficient to determine the condition of the outlet works facilities. No mechanism or device for upstream flow control was observed.

d. Principal Spillway. The condition of the principal spillway was assessed to be poor based on visual observations. Of particular concern were the deteriorated state of the weir wall and the questionable structural capacity of the retaining wall during extended, large spillway flow conditions.

SECTION 4 OPERATIONAL FEATURES

4.1 PROCEDURE

The reservoir pool level is normally maintained by the uncontrolled weir wall of the principal spillway. Normal operation does not require a dam tender. The only operational features of the dam are the two reported 8 inch cast iron water supply pipes. Use of these pipelines has been discontinued, and the water supply control building at the toe of the embankment has been destroyed by vandals.

4.2 MAINTENANCE OF DAM

No planned maintenance schedule is on record. Observations indicate that maintenance procedures are poor.

4.3 MAINTENANCE OF OPERATING FACILITIES

The operating facilities are not maintained.

4.4 WARNING SYSTEM

There is no known warning system or formal emergency procedure to alert and evacuate downstream residents upon threat of a dam failure.

4.5 EVALUATION

Maintenance of the dam and operating facilities is assessed to be poor. The recommendations presented in Section 7 should be implemented as part of a general maintenance and surveillance program at the dam.

SECTION 5 HYDROLOGY AND HYDRAULICS

5.1 EVALUATION OF FEATURES

a. Design Data. The Star Junction No. 1 dam has a watershed of 755 acres which is vegetated primarily by pasture and woodland. The watershed is about one and one half miles long, one half mile wide and has a maximum elevation of 1,400 feet above Mean Sea Level (MSL). The upper 65 percent of the No. 1 dam's watershed is the watershed of Star Junction No. 2 dam. At normal pool, the dam impounds a reservoir with a surface area of 11.9 acres and a storage volume of 149.3 acre-feet. Normal pool level is maintained at Elev. 1046.5 by the spillway weir wall.

Design spillway capacity and embankment freeboard were made sufficient to accomodate 400 cubic feet per second per square mile which was considered sufficient for this structure and watershed at the time of design. Star Junction No. 1 dam spillway capacity for the observed cross section and existing freeboard conditions was computed to be 541 cfs. No additional hydrologic calculations were found relating reservoir/spillway performance to the Probable Maximum Flood or fractions thereof.

b. Experience Data: Continuous records of reservoir level or rainfall amounts are not kept. There is no record or report of the embankment ever being overtopped. However, there was a recorded depth of water of 3.1 feet above the crest of the weir during the storm of 4 June 1941. According to the report, that stage corresponded to a spillway discharge of 620 cfs.

c. Visual Observations: On the date of the field reconnaissance, deterioration of the retaining wall as well as the weir wall was observed. Spillway discharge was restricted by concrete block steps built on the overflow crest section.

d. Overtopping Potential: Overtopping potential was investigated through the development of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway. The Corps of Engineers guidelines recommend 0.5 to 1 times the PMF for "small" size, "high" hazard dams. Based on the observed existing

downstream conditions, Star Junction No. 1 dam has a Spillway Design Flood (SDF) of one PMF.

Hydrometeorological Report No. 33 indicates the adjusted 24 hour Probable Maximum Precipitation (PMP) for the subject site is 19.4 inches. No calculations are available to indicate whether the reservoir and spillway are sized to pass a flood corresponding to 19.4 inches of rainfall in 24 hours. Consequently, an evaluation of the reservoir/spillway system was performed to determine whether the spillway capacity is adequate under current Corps of Engineers guidelines.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California. The major methodologies and key input data for this program are discussed briefly in Appendix D.

The peak inflow to Star Junction No. 1 dam for the SDF was determined by HEC-1 to be 3508 cfs. This value results from the summation of PMF hydrographs for Star Junction No. 2 dam's spillway and embankment crest and the uncontrolled watershed of No. 1 dam.

According to the HEC-1 analysis, at 0.50 PMF, Star Junction No. 1 dam is overtopped by 1.15 feet of water for 5 hours and 45 minutes.

e. Spillway Adequacy: The capacity of the combined reservoir and spillway system was determined to be 0.18 PMF according to the HEC-1 analysis. An initial pool elevation of 1046.5 was assumed prior to commencement of the storm.

According to the Corps of Engineers guidelines for a dam of this size and hazard classification, when a spillway passes less than 50% of the PMF and the dam is judged by the evaluating engineer to fail by overtopping, a breach analysis must be performed in order to determine if the dam's spillway is "seriously inadequate".

For the dam breach analysis, it was assumed that failure would begin when the water level in the reservoir reached elevation 1050.8 which corresponds to a depth of 1 foot above the embankment crest's observed minimum elevation.

To achieve the assumed overtopping failure condition, a 0.45 PMF was routed through the reservoir/spillway system. In this analysis, Star Junction No. 2 dam upstream was not overtopped. Results of the dam breach analysis indicated that downstream flooding would be significantly increased and there would be a significant increase in the risk of loss of life by the assumed failure of No. 1 dam. The stream level in the village of Star Junction would rise 7.8 feet with an increase in flow of 285 percent. On the outskirts of Perryopolis, 1.8 miles downstream, the stage would rise 3.4 feet with an increase in flow of 176 percent.

Therefore, in accordance with Corps of Engineers guidelines, the spillway is rated as "seriously inadequate."

SECTION 6 STRUCTURAL STABILITY

6.1 AVAILABLE INFORMATION

a. Design and Construction Data. All available design documentation, calculations and other data received from PennDER were reviewed. This data is discussed in Section 2 and a listing is included in Appendix B. Selected items are presented in Appendix E.

b. Operating Records. There are no written operating records or procedures for this dam.

6.2 EVALUATION

a. Design Documents. The design documentation was, by itself, considered inadequate to evaluate the structure. There were no structural calculations associated with the stability of the embankment or of the appurtenant structures.

b. Visual Observations.

(1) Embankment: The field inspection disclosed a possible, potentially serious structural deficiency of the embankment, near the left abutment. The non-uniform embankment slope in this area may be the result of gradual, long-term movement of the embankment and/or foundation soils. The downstream toe area below the non-uniformity was observed to be very wet and soft. Also, the embankment crest profile showed a sag in this area. Considerable additional information is necessary to make an assessment of the structural stability of the embankment.

(2) Principal Spillway: The principal spillway weir wall and training dike retaining wall were observed to be undercut and leaking. Based on the field observations, both facilities are assessed to have questionable structural integrity.

c. Performance: PennDER correspondence files contain inspection reports by State personnel that cited low or uneven embankment crest conditions on 16 September 1920, 24 March 1922, 18 April 1923, and 28 January 1936. The exact locations on the embankment of these conditions

were not indicated in the reports but were generally described as left of the abutment of the spillway. In all cases, repairs were reportedly made by the owner.

Also, a massive slide on the embankment's downstream slope occurred on 12 December 1919. The scarp was reported to be 200 feet wide and approached to within 7.5 feet of the crest. The cause of the slide was thought to be a saturated layer or layers of earth fill material about mid-height in the embankment. The location of the saturated zone was at about the elevation of the base of the additional earth fill placed in 1901-1904 to raise the dam. Remedial construction, including an upstream cutoff wall and downstream buttress, was accomplished in 1920.

d. Seismic Stability: According to the Seismic Risk Map of the United States, Star Junction No. 1 dam is located in Zone 1 where damage due to earthquakes would most likely be minor.

A dam located in Seismic Zone 1 may be assumed to present no hazard from an earthquake provided static stability conditions are satisfactory and conventional safety margins exist. Since there is concern regarding the static stability of the embankment, the seismic stability is questionable and should be assessed as part of the investigations recommended in Section 7.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS

7.1 ASSESSMENT

a. Evaluation.

(1) Embankment: Star Junction No. 1 dam's embankment is assessed to be in poor condition. This is based on visual observations of slope non-uniformities, crest sag, embankment toe and downstream area soft conditions, downstream springs, and state inspection reports.

The inability to closely inspect the downstream slope, groins, abutments and toe area due to dense brush, weeds, trees and debris is considered to be a deficiency. Animal burrows observed on the embankment slope are considered to be a deficiency.

The upstream slope erosion protection (riprap) was observed to be in poor condition.

The wheel rutting and ponded water on the embankment crest is considered to be a deficiency.

(2) Outlet Works: The condition of the two reported eight inch cast iron water supply pipelines could not be determined. Several downstream controls were observed but their exact functions were not ascertained. They were not activated to determine operability. No controls or mechanisms were observed to permit upstream flow control.

(3) Principal Spillway: The principal spillway is assessed to be in poor condition. This is based on visual observations of the weir wall and training dike retaining wall. Both structures are badly deteriorated and safe performance is questionable in the event of long-term, high discharge conditions.

(4) Flood Discharge Capacity: The principal spillway flow discharge capacity is assessed to be "seriously inadequate." This is based on hydrologic/hydraulic computations using the HEC-1 Dam Safety Version computer program, that indicated the existing reservoir/spillway system is capable of passing 0.18 PMF and that failure of the structure would significantly increase downstream flood conditions.

(5) Downstream Conditions: Based on the results of the visual observations and the hydrologic/hydraulic computations, the lack of an emergency warning and operation plan is considered to be a deficiency.

b. Adequacy of Information. The available information and the observations made during field inspections of the dam are considered sufficient for purposes of the Phase I inspection report.

c. Urgency. The inspection indicated the existence of several features or deficiencies which may have reduced structural stability of the embankment and spillway to near unacceptable levels. The extent to which deterioration may have progressed and to which they may have weakened the facilities cannot be determined from a Phase I inspection.

d. Necessity for Additional Data/Evaluation. Additional engineering information is required to adequately evaluate the structural stability of the embankment and spillway.

7.2 RECOMMENDATIONS

a. Additional Investigations. It is recommended that the owner immediately retain the services of a registered professional engineer knowledgeable and experienced in the design and construction of earth dams and masonry spillways to provide a detailed engineering investigation of Star Junction No. 1 dam. This investigation should include but not be limited to the following:

(1) Detailed investigation of the seepage and wet conditions and structural stability of the embankment.

(2) Detailed evaluation of spillway capacity and stability and development of recommendations for remedial action to make the spillway capacity adequate.

(3) Investigation of the outlet works with specific recommendations on making them operable and including provisions for upstream flow controls.

b. Emergency Operation and Warning Plan. Concurrent with the additional investigations recommended above, the owner should develop an Emergency Operation and Warning Plan including:

(1) Guidelines for evaluating inflow during periods of heavy precipitation or runoff.

(2) Procedures for around the clock surveillance during periods of heavy precipitation or runoff.

(3) Procedures for rapid drawdown of the reservoir under emergency conditions.

(4) Procedures for notifying downstream residents and public officials, in case evacuation of downstream areas is necessary.

c. Remedial Work. The Phase I Inspection of Star Junction No. 1 dam also disclosed several deficiencies of lower priority which should be corrected immediately.

(1) Closely mow the embankment slopes, crest, groins, abutments and immediate downstream areas. Remove the cuttings from the site.

(2) Locate and backfill completely, all animal burrows on the embankment, groins and adjacent abutment areas.

(3) Replace lost riprap along the upstream slope of the embankment.

(4) Fill wheel ruts and minor erosion gullies on the embankment and adjacent areas.

(5) Develop and implement formal maintenance and inspection procedures.

Vehicles should not be permitted on the crest of the embankment until the recommended additional investigations have shown that crest traffic is acceptable. Also, the embankment crest should not be raised at least until completion of the additional investigations.

d. Orderly Breaching: In lieu of performing the above recommendations, the owner should engage the services of a professional engineer, knowledgeable in dam design and performance, to prepare specifications for breaching the structure, to make it incapable of impounding water. The structure should then be breached under the direction of the professional engineer and in accordance with applicable state and local regulations.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL OBSERVATIONS CHECKLIST I
(NON-MASONRY IMPOUNDING STRUCTURE)

Name Dam Star Junction No. 1 County Fayette State Pennsylvania National ID # PA 00198

Type of Dam Earth Hazard Category High

Date (s) Inspection 7 November 1979 and 1 February 1980

Weather Cloudy, cool on 7 November 1979; Clear, cold on 1 February 1980.

Temperature 40°F on 7 November 1979; 25°F on 1 February 1980.

Pool Elevation at Time of Inspection 1046.5 (MSL)

Tailwater at Time of Inspection Unknown

Inspection Personnel: J. E. Barrick*, P.E. Ackenheil & Associates, Hydrologist and
(7 November 1980) Project Manager.

J. P. Hannan

S. G. Mazzella*

J. B. Zeppieri

L. D. Busack

William McCormick

Ackenheil & Associates, Geotechnical Engineer
Ackenheil & Associates, Civil Engineer

Ackenheil & Associates, Geologist

PennDER, Bureau of Dams and Waterways Management,

Regional Hydraulic Engineer

Bentleyville, Pennsylvania, Owner

*Returned for follow-up inspection, 1 February 1980.

Recorder J. E. Barrick

GEO Project G79153-B
PennDER I.D. No. 26-30

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Small drying cracks (no separation) observed. Minor tension crack in recently placed earth material near principal spillway. Upstream slope mostly grassed with small weeds and traces of riprap. Downstream slope heavily vegetated with grass, weeds, small woody plants. Trees have recently been cut and now litter slope making thorough inspection impossible. Crest appears to have been raised 1 to 2 feet in recent time (several years).	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed from center to right. Flattening of toe observed on left. Path crosses slope from crest to toe (see Field Plan).	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed in immediate dam vicinity. Long-term erosion has occurred near and below the 9 inch cast iron (inside diameter) pipe outlet in the left abutment approximately 100 feet downstream of the crest centerline.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Crest is approximately level. Dips slightly to left but elevation difference is small. Crest centerline is generally straight and roughly perpendicular to the axis of the valley through the center portion of the dam. Crest turns upstream at each end of the embankment.	
RIPRAP FAILURES	Traces of riprap at and below reservoir water line. Riprap appears to extend up the upstream slope to approximately 2 feet below current crest. Generally overgrown and earth covered in places.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SETTLEMENT	None observed except for crest sag.	See Field Profile.
JUNCTION OF EMBANKMENT AND ABUTMENT, RIGHT (PRINCIPAL) SPILLWAY AND DAM	Left Groin-no evidence of erosion or seeping water. Generally brush and weed covered. Right groin-uneroded and dry. Seeping water visible at base of spillway retaining wall (embankment side) in reach 0 to 18 feet below spillway weir. Flows generally small-not greater than 5 gpm.	
ANY NOTICEABLE SEEPAGE	In addition to the seeps noted above, several areas below the toe of the embankment, in the original flood plain, are wet and emitting water to drainage swales. These wet spots are approximately located on the Field Plan. Three springs observed-upper emitting 5+ gpm, middle emitting 1+ gpm and lower emitting 2+ gpm. Total drainage channel flow near its confluence with creek - 12-15 gpm.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Three gate valves in valve pits observed. Four pits observed. Considerable piping visible within and adjacent to concrete block building ruins. No apparent exit of piping from or beneath embankment.	
OUTLET STRUCTURE	None observed.	
OUTLET CHANNEL	None.	
EMERGENCY GATE	Unknown.	

PRINCIPAL (UNGATED) SPILLWAY

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	The flow controlling weir consists of a very old, badly deteriorated concrete slab, approximately 4 feet thick upon which a stone and mortar wall has been constructed on the right (abutment) side. The slab connects directly to the stone and mortar training wall on the left (embankment) side. Concrete block steps have been mortared atop the slab on both sides of the spillway. Slab is tilted slightly toward the abutment (right).	
APPROACH CHANNEL	Unobstructed and of sufficient size not to restrict inflow to weir crest. Right (abutment) side is natural stream bank. Left (embankment) side is stone and mortar retaining wall.	
DISCHARGE CHANNEL	Stone and mortar retaining wall on left (embankment) retains earthfill training dike that extends more than 100 feet downstream of the embankment crest. Retaining wall foundation deteriorating. Wall has many open joints. Wall collapsing near lower end permitting erosion of earth dike. Natural, wooded stream bank forms the right (abutment) discharge channel wall. Channel bottom consists of bedrock. The discharge channel bottom slope is 0.053 feet/foot over the 150 feet immediately below the overflow weir (see Field Plan).	
BRIDGE AND PIERS	Not applicable.	

DOWNSTREAM CHANNEL

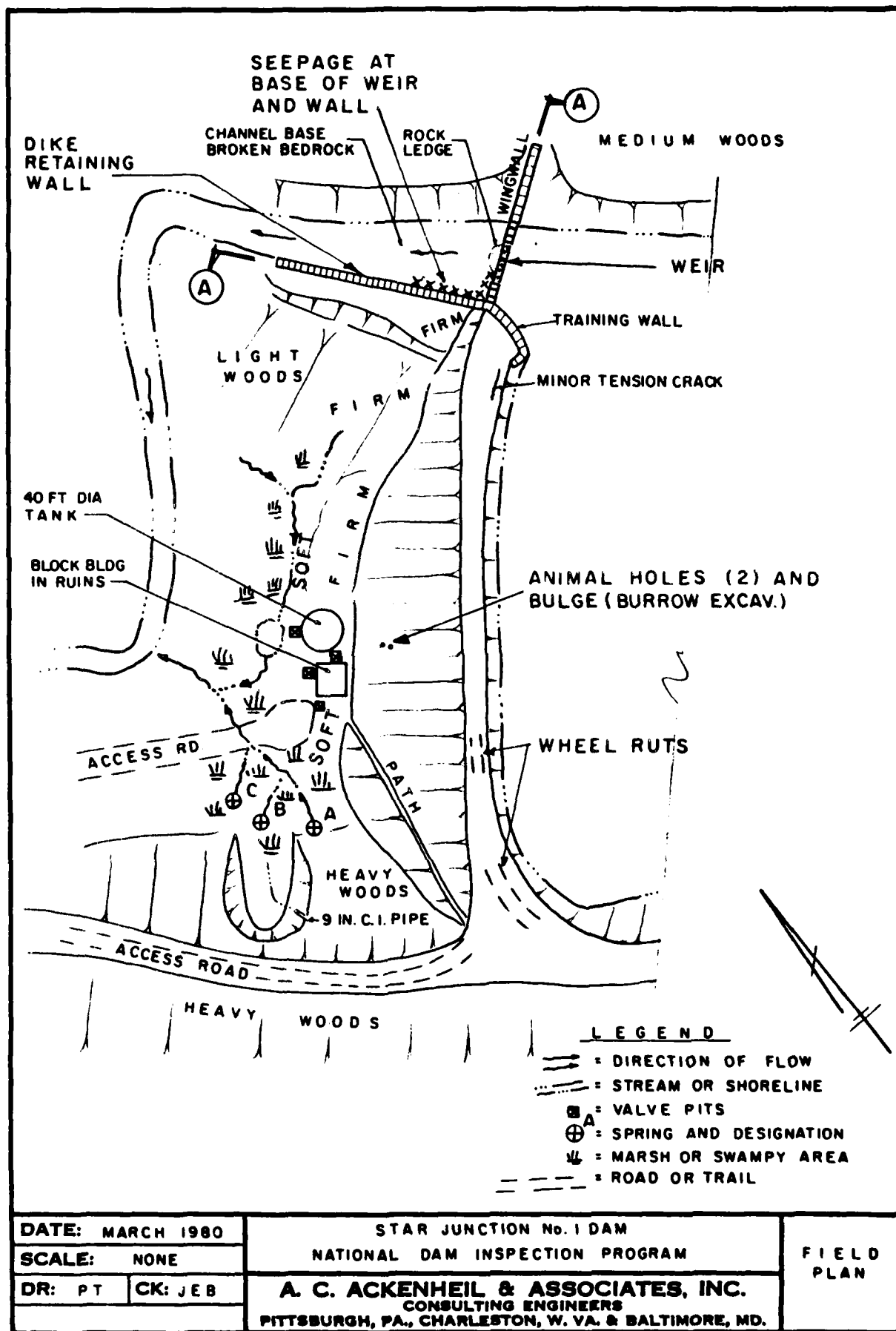
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Generally clear and straight for a distance of 200 feet downstream. Tree lined both sides below training dike. Rock channel bottom with no major obstructions. Channel turns sharply to left, parallels embankment crest, turns sharply right and enters original creek channel in middle of flood plain. Valley below is broad and very flat.	
SLOPES	Slope immediately below overflow weir is 0.053 feet/foot (first 150 feet of discharge channel).	
APPROXIMATE NO. OF HOMES AND POPULATION	Several habited dwellings located on lowest terrace of flood plain in the first 2000 foot reach below the embankment. A major highway (PA St. Rte. 51) parallels the creek for more than 1 mile beginning about 3000 feet below the embankment.	

INSTRUMENTATION

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHER		

RESERVOIR

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>SLOPES</u>	Right side-generally flat, tree covered slopes. Left side-forested, somewhat steeper with some minor slumping observed along shoreline.	
<u>SEDIMENTATION</u>	No significant sedimentation observed.	
<u>INLET STREAMS</u>	Natural drainage course enters from the northeast via winding channel, flat bottom valley. Deltaic development with brush and small trees growing.	
	Second inlet stream is principal spillway of Star Junction No. 2 dam.	
<u>WATERSHED</u>	Generally steep slopes - mostly pasture and woodland. No mining or major construction observed.	



DATE: MARCH 1980

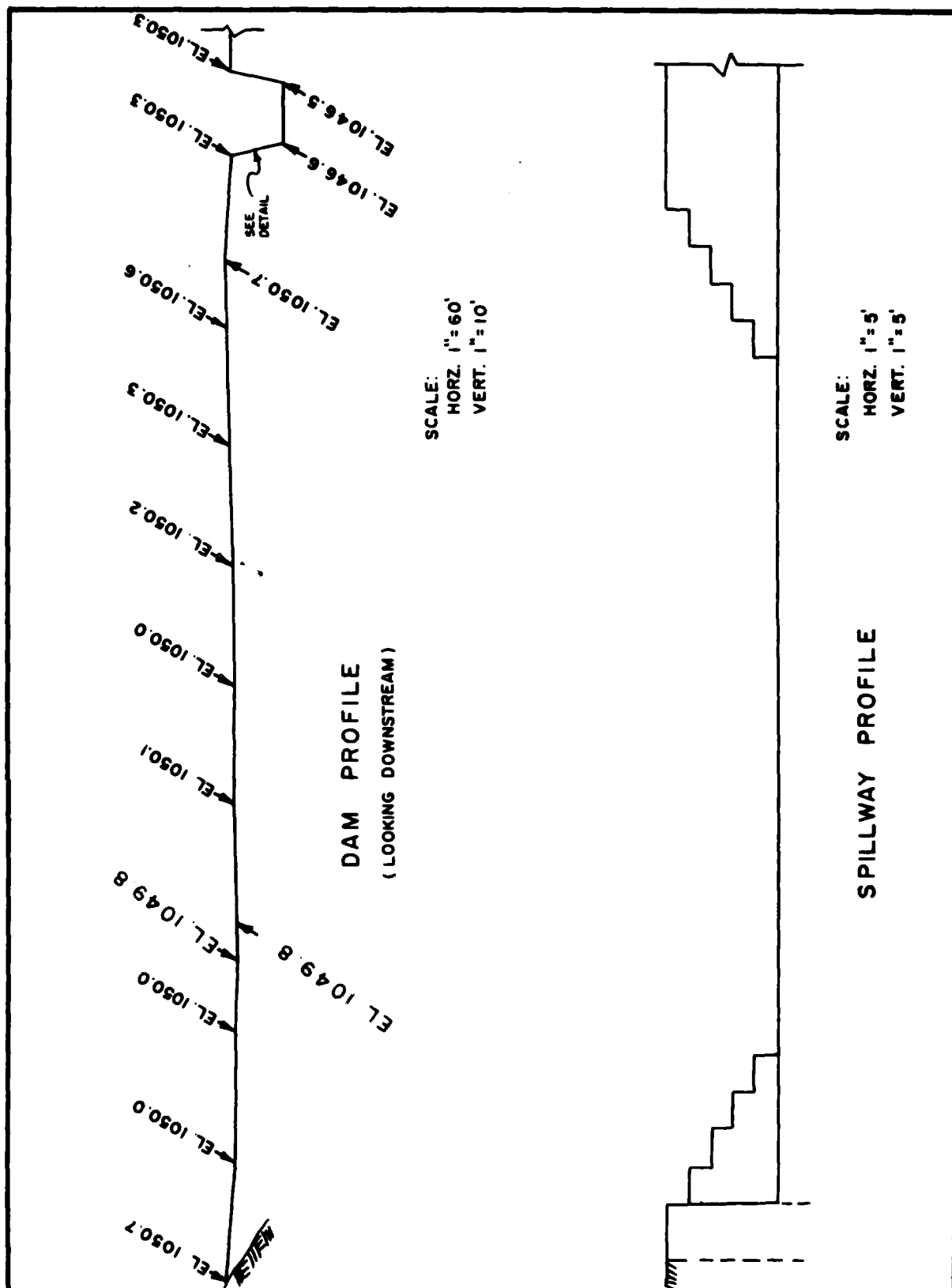
SCALE: NONE

DR: PT CK: JEB

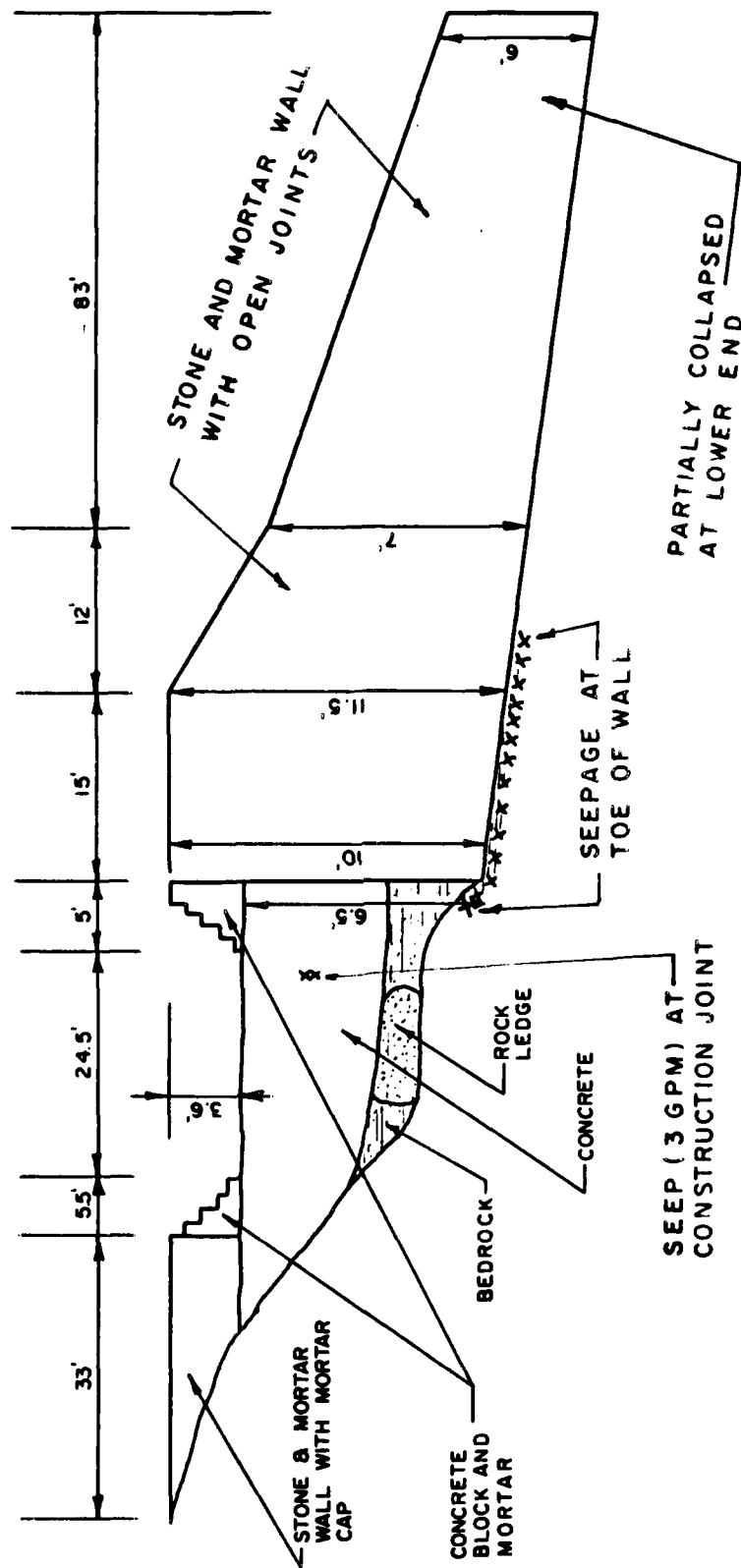
STAR JUNCTION No. 1 DAM
NATIONAL DAM INSPECTION PROGRAM

A. C. ACKENHEIL & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA, CHARLESTON, W. VA. & BALTIMORE, MD.

FIELD
PLAN



DATE: MARCH 1980		STAR JUNCTION No.1 DAM NATIONAL DAM INSPECTION PROGRAM	FIELD PROFILES
SCALE: AS SHOWN			
DR: PT	CK: JEB	A. C. ACKENHEIL & ASSOCIATES, INC. CONSULTING ENGINEERS PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.	



FIELD SECTION A-A
SEE FIELD PLAN

DATE: MARCH 1980

SCALE: NONE

DR: PT CK: JEB

STAR JUNCTION NO. 1 DAM

NATIONAL DAM INSPECTION PROGRAM

A. C. ACKENHEIL & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.

FIELD
SECTION

APPENDIX B
ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM: Star Junction No. 1
I.D. NO. 00198

ITEM	REMARKS
*As-Built Drawings	<p>Drawings by Thomas M. Zimmerman, Washington Coal and Coke Company dated 1900, July 1917 and 22 December 1919 including:</p> <p>"Plan and cross-sections of No. 1 Reservoir, Washington Coal and Coke Company, Star Junction" showing 11 cross sections of the reservoir and a plan view of the reservoir, dam and surrounding area. See Plate II.</p> <p>Three cross-sections of the embankment showing holes along the dam and water heights and a plan view of same. See Plate III.</p> <p>A plan of view of "No. 1 Reservoir Spillway" a "front sectional view of spillway" and three spillway cross-sections showing details of proposed improvements. See Plate IV.</p>
Design Drawings	None available.
Regional Vicinity Map	USGS 7-1/2 Minute Fayette City, Pennsylvania Quadrangle.

ITEM	REMARKS
*Construction History	Built by E. J. Taylor of the Washington Coal and Coke Company in 1892 with various documented modifications in 1901, 1902, 1903, 1904, 1917, 1920 and 1936.
*Typical Sections of Dam	See As-Built Drawings above.
Outlet Discharge Ratings	None available.
Rainfall/Reservoir Records	None recorded.
Design Report	None available.
Geology Report	None available.
*Hydrology and Hydraulics	Wasteway capacity computations dated 19 November 1914 and 6 January 1915.
Design Computations Dam Stability Seepage Studies	None available.
Materials Investigations Boring Records Laboratory Field	None available.
*Post-Construction Surveys of Dams	See As-Built Drawings above.
Borrow Sources	None reported.
Monitoring Systems	None reported.

ITEM	REMARKS
*Modifications	<p>See As-Built Drawings above.</p> <p>See "Report upon the Application of the Washington Coal and Coke Company for permission to make a change to the Spillway of the No. 1 Dam across a branch of Washington Run, Perry Township, Fayette County," dated 13 August 1917.</p> <p>See "Progress reports upon the repairing of the No. 1 Dam of the Washington Coal and Coke Company," dated 24 September 1920 and 29 April 1921.</p> <p>See "Permit to make a change in the spillway of No. 1 Dam," dated 1 August 1917.</p>
*High Pool Records	<p>See correspondence dated 19 January 1951 concerning flood of 4 June 1941. Flow of 620 cfs; height in spillway 3.1 feet.</p>
*Post-Construction Engineering Studies and Reports	<p>See Modifications above.</p> <p>See "Report upon Dam No. 1 of the Washington Coal and Coke Company" dated 5 January 1915 and "Supplementary Report" dated 19 June 1915 and "Post Construction Report upon the Application of the Washington Coal and Coke Company dated 7 July 1917.</p>

ITEM	REMARKS
#Prior Accidents or Failure of Dam Description Reports	Correspondence between Washington Coal and Coke and State of Pennsylvania personnel - December 1919 and early 1920, on failure of downstream slope of embankment.
Maintenance, Operation, Records	None available.
#Spillway-Plan Sections Details	See As-Built Drawings above.
Operating Equipment Specifications	None available. None available.
Miscellaneous	None available.

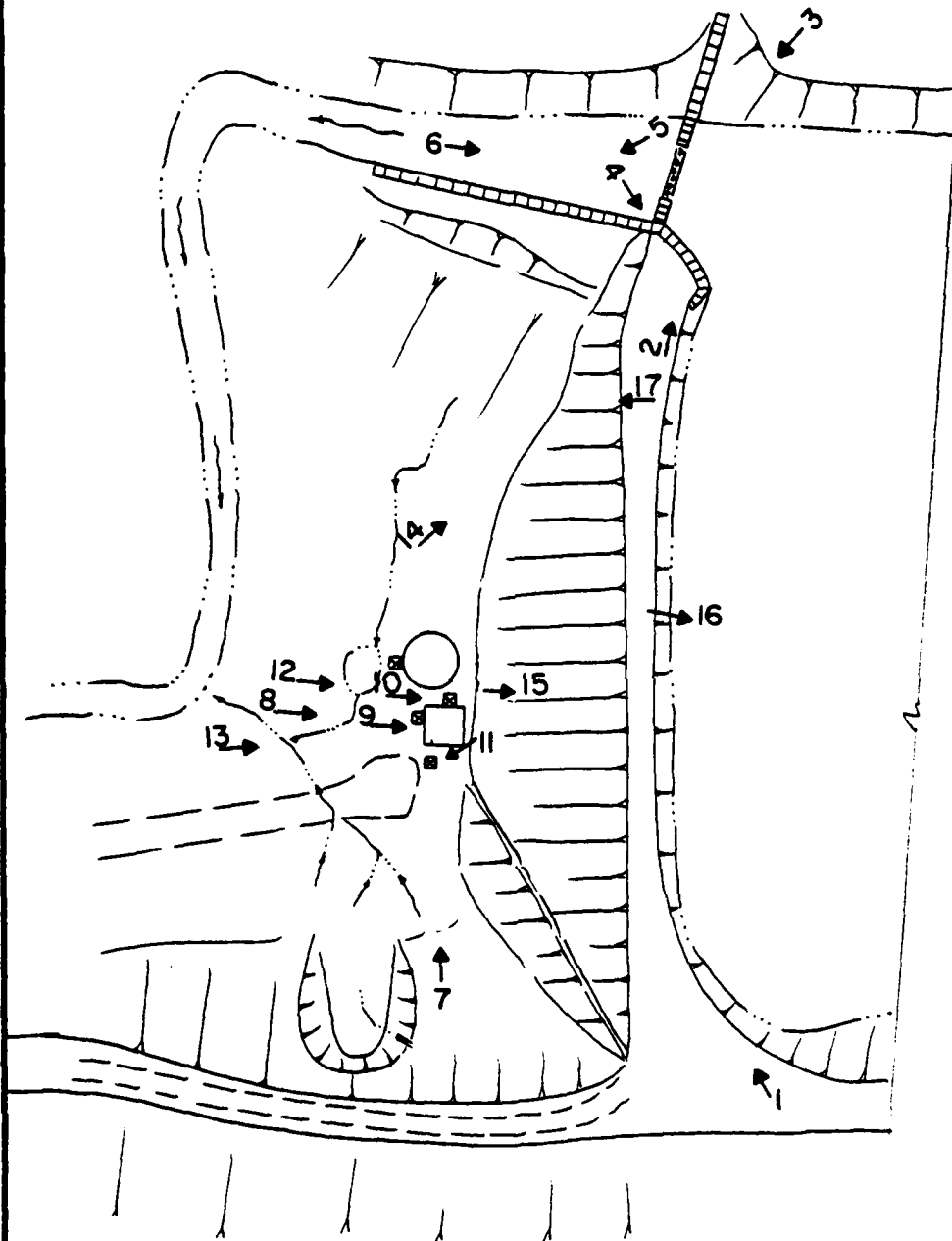
24

* Information and data may be obtained from the Pennsylvania Department of Environmental Resources, Harrisburg, Pennsylvania.

** Reduced size reproductions contained in Appendix E.

APPENDIX C
PHOTOGRAPHS

PHOTO 18 LOCATION NOT SHOWN



DATE: MARCH 1980

SCALE: NONE

DR: PT CK: JEB

STAR JUNCTION NO. 1 DAM
NATIONAL DAM INSPECTION PROGRAM

A. C. ACKENHEIL & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.

PHOTO
KEY
MAP

STAR JUNCTION No. 1 DAM



PHOTO 1. VIEW OF EMBANKMENT CREST

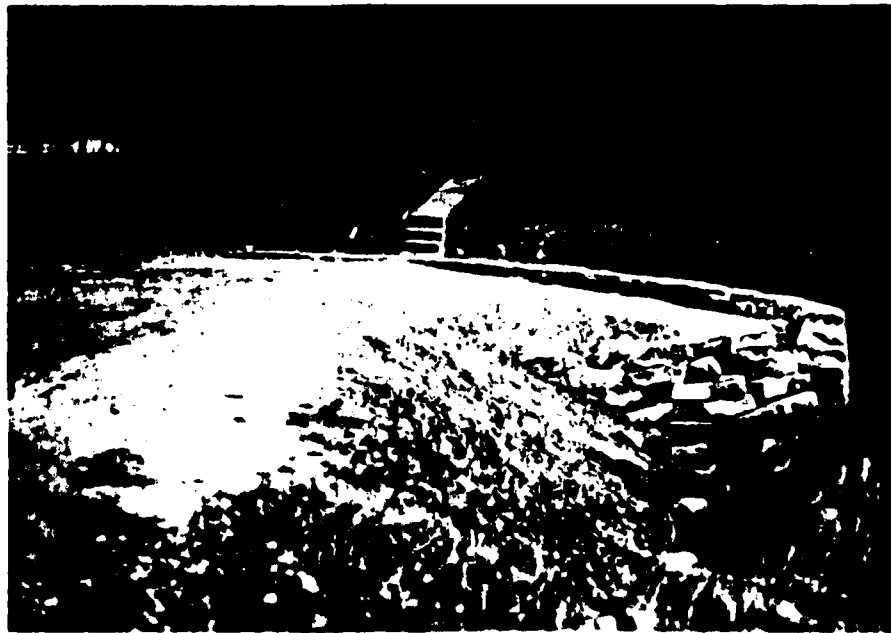


PHOTO 2. DETERIORATION OF RIGHT EMBANKMENT CREST NEAR
SPILLWAY TRAINING WALL

STAR JUNCTION No.1 DAM



PHOTO 3. OVERVIEW OF SPILLWAY APPROACH CHANNEL



PHOTO 4. CLOSE-UP OF WEIR AND
RETAINING WALL

STAR JUNCTION No.1 DAM



PHOTO 5. SPILLWAY RETAINING WALL AND DISCHARGE CHANNEL



PHOTO 6. OVERVIEW OF SPILLWAY WEIR FROM DISCHARGE CHANNEL.

STAR JUNCTION No.1 DAM



PHOTO 7. OVERVIEW OF DOWNSTREAM EMBANKMENT SLOPE



PHOTO 8. VIEW OF CHLORINATION HOUSE AND WATER STORAGE
TANK

STAR JUNCTION No.1 DAM

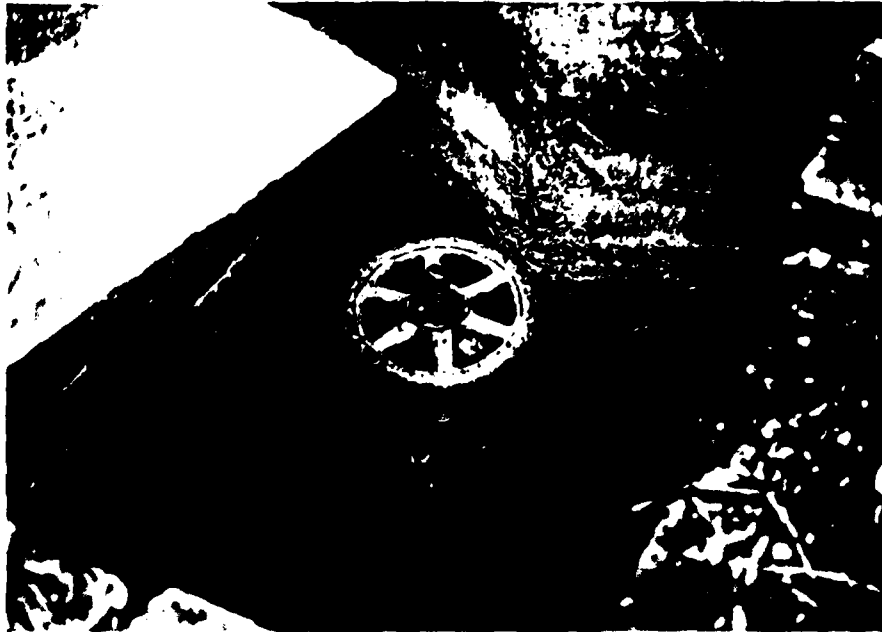


PHOTO 9. FLOODED GATE VALVE CONTROL CHAMBER,
NORTHWEST SIDE OF CHLORINATION HOUSE

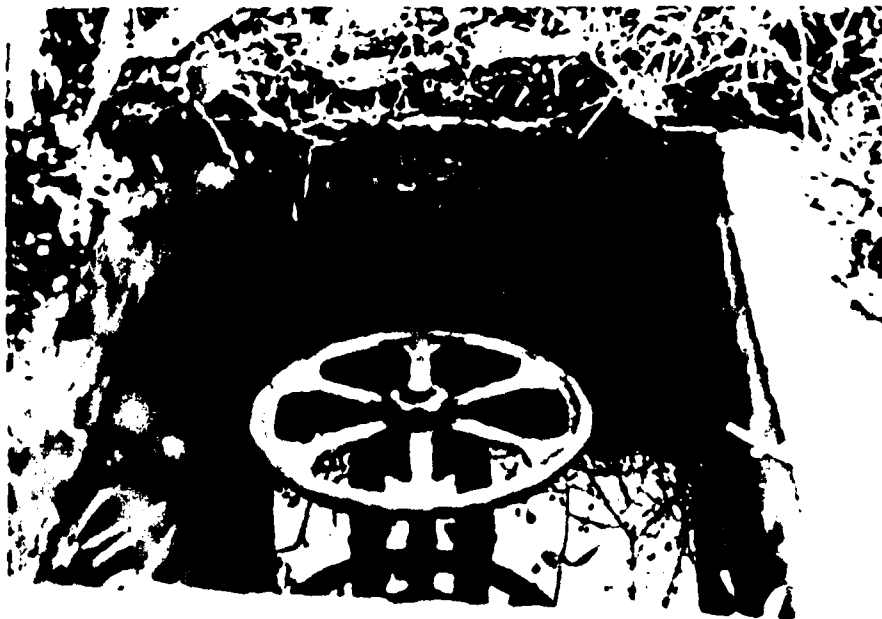


PHOTO 10. FLOODED GATE VALVE CONTROL CHAMBER BETWEEN
CHLORINATION HOUSE AND WATER STORAGE TANK

STAR JUNCTION No 1 DAM



PHOTO 11 FLOODED GATE VALVE CONTROL CHAMBER, SOUTHWEST
SIDE OF CHLORINATION HOUSE



PHOTO 12. PONDED WATER DOWNSTREAM OF
STORAGE TANK

STAR JUNCTION No.1 DAM

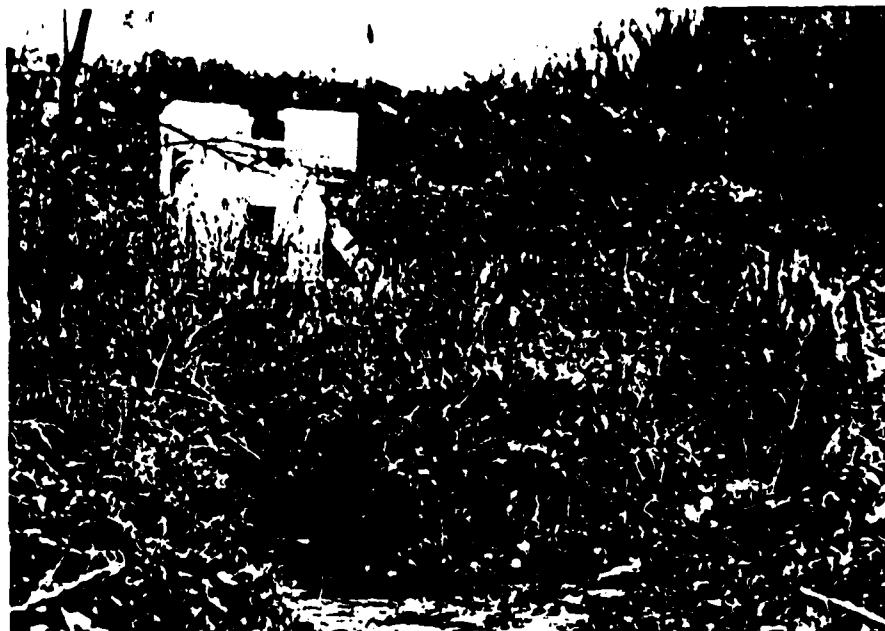


PHOTO 13. FLOWING WATER BELOW DAM



PHOTO 14. RIGHT DOWNSTREAM EMBANKMENT SLOPE

STAR JUNCTION No. 1 DAM



PHOTO 15. ANIMAL BURROW IN DOWNSTREAM EMBANKMENT SLOPE

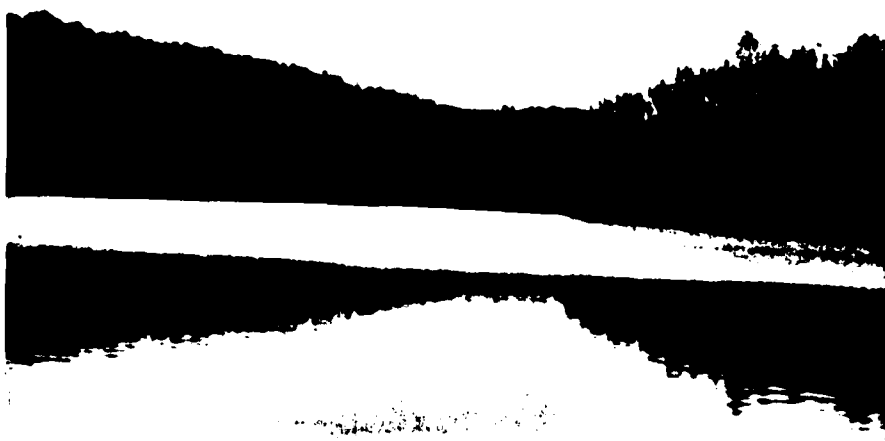


PHOTO 16. VIEW OF STAR JUNCTION No. 1 RESERVOIR

STAR JUNCTION No. 1 DAM



PHOTO 17. DOWNSTREAM VIEW FROM EMBANKMENT CREST



PHOTO 18. INHABITED RESIDENCES DOWNSTREAM OF DAM

DETAILED PHOTO DESCRIPTIONS

- Photo 1 View of Embankment Crest from left abutment.
Vehicle path and tire ruts present on crest.
- Photo 2 Deterioration of Right Embankment Crest near
Spillway Training Wall.
- Photo 3 Overview of Spillway Approach Channel from
right bank.
- Photo 4 Close-up of Weir and Retaining Wall. Note
concrete block steps, deterioration of
weir and wall, and erosion of channel bed.
- Photo 5 Spillway Retaining Wall and Discharge Channel.
Note channel bed erosion and trees growing at
base of wall.
- Photo 6 Overview of Spillway Weir from Discharge Channel.
Looking upstream.
- Photo 7 Overview of Downstream Embankment Slope from
left abutment. Chlorination house (in ruins)
and water storage tank at toe of embankment.
- Photo 8 View of Chlorination House and Water Storage
Tank.
- Photo 9 Flooded Gate Valve Control Chamber, Northwest
Side of Chlorination House.
- Photo 10 Flooded Gate Valve Control Chamber Between
Chlorination House and Water Storage Tank.
- Photo 11 Flooded Gate Valve Control Chamber, Southwest
Side of Chlorination House.
- Photo 12 Ponded Water Downstream of Water Storage Tank.
- Photo 13 Flowing Water Below Dam. Left branch from
ponded water in Photo 12. Right branch from
Springs A, B and C and wet area below left
portion of the embankment. Channel discharges
to creek immediately downstream of photo.
- Photo 14 Right Downstream Embankment Slope showing dense
brush and weeds.

- Photo 15 Animal Burrow in Downstream Embankment Slope
- Photo 16 View of Star Junction No. 1 Reservoir from embankment crest. Star Junction No. 2 dam visible at upper end of reservoir.
- Photo 17 Downstream View from Embankment Crest.
- Photo 18 Inhabited Residences Downstream of Dam. View is into Star Junction, Pennsylvania. Creek passes under bridge in center of photo.

APPENDIX D
HYDROLOGY AND HYDRAULICS
ANALYSES

APPENDIX D HYDROLOGY AND HYDRAULICS

Methodology: The dam overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version, July 1978), prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation: The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph: The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters, their definition and how they were obtained for these analyses.

<u>Parameter</u>	<u>Definition</u>	<u>Where Obtained</u>
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel	From U.S.G.S. 7.5 minute topographic map
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic map

Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic map

3. Routing: Reservoir routing is accomplished by using Modified Puls routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation-discharge relationship.

Storage in the pool area is defined by an area-elevation relationship from which the computer calculates storage. Surface areas are either planimeted from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping: Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach: The computer is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the prefailure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used. In the downstream flood wave routing, pre- and post-failure water depths are calculated at locations where the cross-sections are input.

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominately woodland and pasture.

ELEVATION TOP NORMAL POOL (STORAGE
CAPACITY): 1046.5 (149.3 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE
CAPACITY): 1049.8 (189 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: Design 1050

ELEVATION TOP DAM: Design 1050.0, observed minimum 1049.8

OVERFLOW SECTION

- a. Elevation 1046.5
- b. Type Concrete and masonry weir wall.
- c. Width 24.5 to 35.2 feet
- d. Length N/A
- e. Location Spillover Right abutment
- f. Number and Type of Gates None

OUTLET WORKS

- a. Type 8 inch cast iron - two reported
(water supply pipes)
- b. Location Left of embankment center
- c. Entrance Inverts Unknown
- d. Exit Inverts Unknown
- e. Emergency Drawdown Facilities Unknown

HYDROMETEOROLOGICAL GAGES

- a. Type None
- b. Location N/A
- c. Records None

MAXIMUM REPORTED NON-DAMAGING DISCHARGE 620 cfs, 4 June 1941

HEC-1 DAM SAFETY VERSION
HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

	No. 1 Dam	No. 2 Dam
NAME OF DAM:	Star Junction No. 1 Dam	
	NDI ID NO. PA 198	NDI ID NO. PA 212
Probable Maximum Precipitation (PMP)	24.2*	24.2*
Drainage Area (Uncontrolled)	0.41 sq. mi.	0.77 sq. mi.
Reduction of PMP Rainfall for Data Fit	0.8 (24.2)	0.8 (24.2)
Reduce by 20%, therefore PMP rainfall	=19.4 in.	=19.4 in.
Adjustments of PMF for Drainage Area (Zone 7)		
6 hrs.	102%	102%
12 hrs.	120%	120%
24 hrs.	130%	130%
Snyder Unit Hydrograph Parameters		
Zone	25**	25**
C _p	0.4	0.4
C _t	1.0	1.0
L	0.95 mi.	1.13 mi.
L _{ca}	0.47 mi.	0.57 mi.
t _p = C _t (L · L _{ca}) ^{0.3} =	0.79 hrs.	0.88 hrs.
Loss Rates		
Initial Loss	1.0 in.	1.0 in.
Constant Loss Rate	0.05 in./hr.	0.05 in./hr.
Base Flow Generation Parameters	1.5 cfs/sq. mi.	
Flow at Start of Storm	=0.62 cfs	=1.16 cfs
Base Flow Cutoff	0.05xQ peak	0.05xQ peak
Recession Ratio	2.0	2.0
Overflow Section Data		
Crest Length	24.46-35.15 ft.	41 ft.
Freeboard	3.3 ft.	4.3 ft.
Discharge Coefficient	2.63-3.24	2.6
Exponent	1.5	1.5
Discharge Capacity	541 cfs	951 cfs

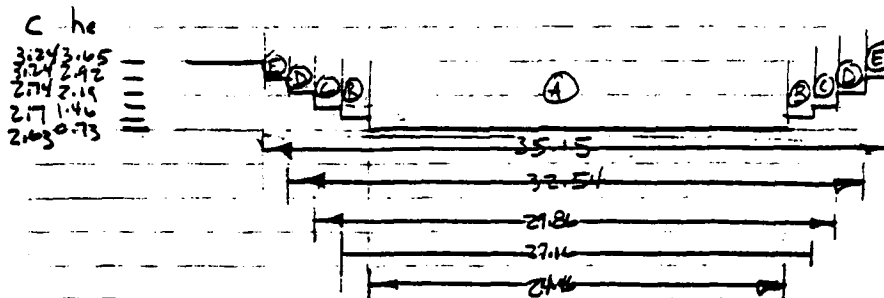
* Hydrometeorological Report 33

**Hydrological zone defined by Corps of Engineers,
Baltimore District, for determining Snyder's Coefficients
(C_p and C_t).

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Job STAR JUNCTION NO. 1 DAM Job No. 79153B
Subject SPILLWAY RATING CURVE
Made By JDH Date 3/10/80 Checked SGM Date 3/19/80

STAR JUNCTION NO. 1 DAM SPILLWAY RATING CURVE



STAGE - DISCHARGE AREA (A) $L = 2446$ $Q = CLH^{3/2}$

STAGE	head	C	Q
0	0	-	0
0.73	0.73	2.63	40.1
1.46	1.46	2.70	116.5
2.19	2.19	2.74	217.2
2.92	2.92	3.24	395.4
3.65	3.65	3.24	552.6
4.5	4.5	3.24	756.5
5.0	5.0	3.24	886.0
6.5	6.5	3.24	1313.32

STAGE - DISCHARGE AREA (B) $L = 2.7'$ $Q = CLH^{3/2}$

STAGE	head	C	Q
0	0	-	0
0.73	0	-	0
1.46	0.73	2.63	4.4
2.19	1.46	2.70	12.9
2.92	2.19	2.74	24.0
3.65	2.92	3.24	43.6
4.5	3.77	3.24	64.0
5.0	4.27	3.24	77.2
6.5	5.77	3.24	125.2

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Job STAR JUNCTION NO 1 DAM Job No. 79/53B
Subject SPILLWAY RATING CURVE
Made By WPH Date 3/10/80 Checked SGM Date 3/19/80

STAGE DISCHARGE AREA (C) $L = 2.7$ $Q = CLH^{3/2}$

STAGE	head	C	Q
0	0		
0.73	0		
1.46	0		
2.19	0.73	2.63	4.4
2.92	1.46	2.70	12.9
3.65	2.19	2.74	26.0
4.5	3.04	3.24	46.14
5.0	3.54	3.24	58.3
6.5	5.04	3.24	99.0

STAGE DISCHARGE AREA (D) $L = 2.7$ $Q = CLH^{3/2}$

STAGE	head	C	Q
0	0		
0.73	0		
1.46	0		
2.19	0		
2.92	0.73	2.63	4.4
3.65	1.46	2.70	12.9
4.5	2.31	2.74	26.0
5.0	2.81	3.24	41.2
6.5	4.31	3.24	78.3

STAGE DISCHARGE AREA (E) $L = 2.7$ $Q = CLH^{3/2}$

STAGE	HEAD	C	Q
0	0		
0.73	0		
1.46	0		
2.19	0		
2.92	0		
3.65	0.73	2.63	4.4
4.5	1.58	2.70	14.5
5.0	2.08	2.74	22.2
6.5	3.58	3.24	59.3

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Sheet _____ of _____
Job STAR JUNCTION NO. 1 DAM Job No. 79153B
Subject SPILLWAY RATING CURVE
Made By JPH Date 3/10/80 Checked SGM Date 3/19/80

TOTAL Q = Σ ALL FLOWS AT EACH STAGE ELEVATION

STAGE	DISCHARGE	Elev.
0	0	1046.50
0.73	40.1	1047.23
1.46	120.9	1047.96
2.19	234.5	1048.69
2.92	436.7	1049.42
3.65	637.5	1050.15
4.5	907.4	1051.0
5.0	1084.9	1051.5
6.5	1671.1	1053.0

LOSS RATES AND BASE FLOW PARAMETERS

As Recommended By CORP OF ENGINEERS, BALTIMORE DISTRICT

STRTL = 1 inch
CNSTL = 0.5 inch/hour
STRTRQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% of Peak Flow)
RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS - NO. 2 DAM

FROM USGS 7.5 MIN. QUAD, PENN DEE FILES AND FIELD
INSPECTION DATA

AT SPILLWAY CREST ELEVATION — 1064.9

INITIAL STORAGE — 31 ACRES-FT

POND SURFACE AREA — 6 ACRES

AT ELEVATION 1080 , AREA = 10.1 ACRES

AT ELEVATION 1100 , AREA = 29.4 ACRES

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Sheet _____ of _____
Job Star Junction No 1 Dam Job No. 79153B
Subject STORAGE - Volume - AREA RELATIONS
Made By JP H Date 3/3/80 Checked _____ Date _____

FROM CONIC METHOD OF RESERVOIR VOLUME
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION (USER'S MANUAL)

$$H = 3V/A$$

$$= 3(31)/6$$

$$= 15.5 \text{ FEET}$$

ELEVATION WHERE AREA EQUALS ZERO

$$1064.9 - 15.5 = 1049.4$$

AREA	\$A	0	6	10.1	29.4
ELEVATION	\$E	1049.4	1064.9	1080	1100

ELEVATION - AREA - CAPACITY RELATIONSHIPS - No. 1 Dam

FROM USGS 7.5 MIN. QUAD PENNDEK FILES AND FIELD
INSPECTION DATA

AT SPILLWAY CREST ELEVATION — 1046.5

INITIAL STORAGE — 149 ACRES-FT

AT ELEVATION 1046.5 AREA = 12 ACRES

AT ELEVATION 1060, AREA = 14 ACRES

AT ELEVATION 1080, AREA = 43 ACRES

AT ELEVATION 1100 AREA = 55 ACRES

FROM CONIC METHOD OF RESERVOIR VOLUME

$$H = 3V/A$$

$$= 3(149)/12$$

$$= 37.25$$

ELEVATION WHERE AREA EQUALS ZERO

$$1046.5 - 37.3 = 1009.2$$

AREA	\$A	0	12	14	43	55
ELEVATION	\$E	1009.2	1046.5	1060	1080	1100

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Sheet _____ of _____

Job STAR JUNCTION NO1 Dam Job No. 79153 B
Subject OVERTOP PARAMETERS & PROGRAM SCHEDULE
Made By JDH Date 3/11/80 Checked _____ Date _____

OVERTOP PARAMETERS

No 2 Dam

No 1 Dam

TOP OF DAM ELEVATION (MINIMUM) 1069.2 1049.8

LENGTH OF DAM (EXCLUDING SPILLWAY) 300 ft 500

COEFFICIENT OF DISCHARGE (C) 2.65 2.6

\$L MAX

324

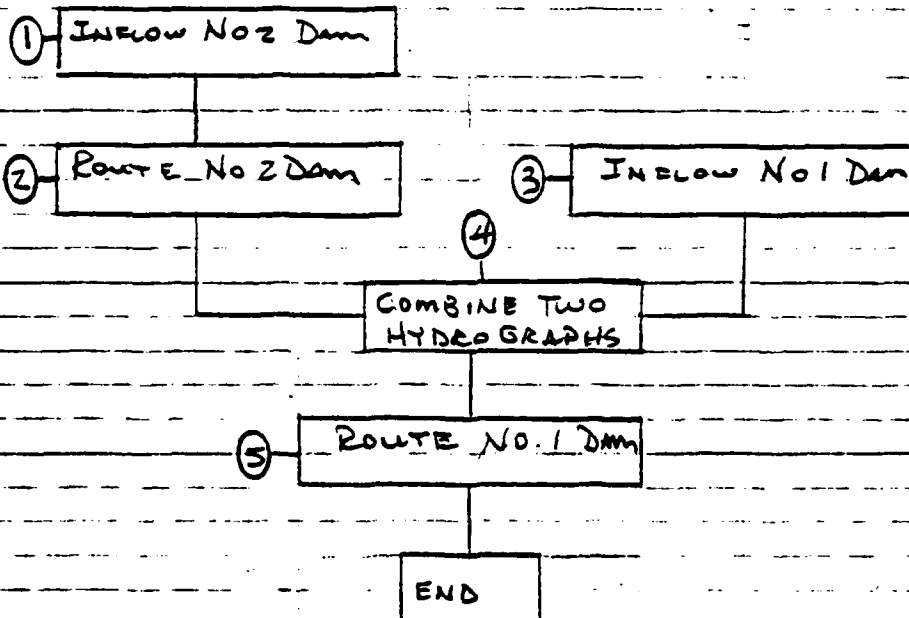
562

\$V MAX

1074

1055

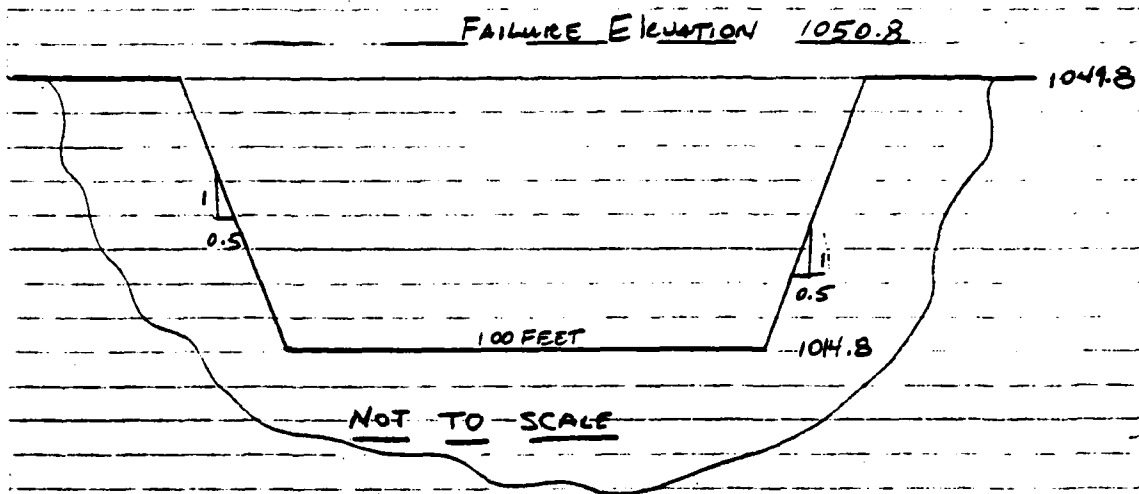
PROGRAM SCHEDULE



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Sheet _____ of _____
Job Star Junction No 1 Dam Job No. 79153A
Subject BREACH AND CHANNEL Routing Profile
Made By JPH Date 3/18/80 Checked _____ Date _____

BREACH PARAMETERS



RATIO OF PMF (RTIO) = 0.45

SIDE SLOPE OF BREACH (Z) = 0.5

FAILURE (TFAIL) = 1 HR.

CHANNEL ROUTING

CHANNEL CROSS SECTIONS TAKEN FROM U.S. G.S.

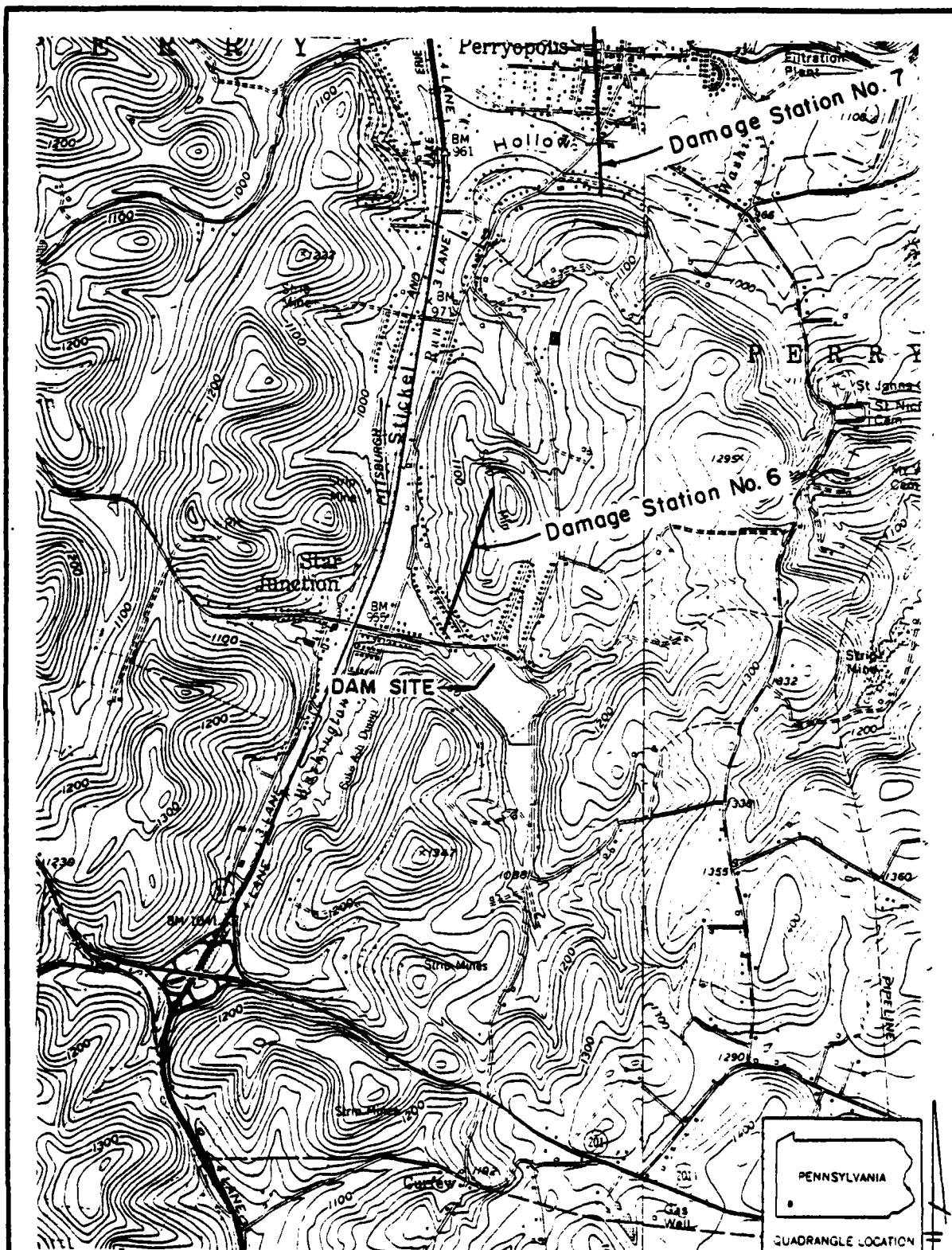
7 1/2' QUAD.

CHANNEL MANNING'S "n"

$Q_N(z) = 0.3 \text{ (Spec.)}$
 0.4 (Gen.)

OVER BANK MANNING'S "n"

$Q_N(u) = 0.056$
 0.07



FAYETTE CITY and DAWSON U.S.G.S. 7 1/2 min. QUADRANGLES

DATE: MARCH 1980

SCALE: 1" = 2000'

DR: PT CK: JPH

STAR JUNCTION No. 1 DAM
NATIONAL DAM INSPECTION PROGRAM

A. C. ACKENHEIL & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.

DAMAGE
STATION
MAP

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

1	A1	NATIONAL PROGRAM FOR THE INSPECTION OF NON-FEDERAL DAMS									
2	A1	HYDROLOGIC AND HYDRAULIC ANALYSIS OF STAR JUNCTION NUMBER 1 DAM									
3	A1	PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDERS METHOD									
4	B	300	0	5	0	0	0	0	0	0	0
5	B1	5									0
6	J	1	6	1							
7	J1	1.0	0.5	0.4	0.3	0.2	0.1				
8	K	0	1								
9	K1	INFLOW HYDROGRAPH FOR NUMBER 2 DAM									
10	M	1	1	0.77							
11	P		19.4	102	120	130					
12	T										
13	W	0.88	0.40					1.0	0.05		
14	X	-1.5	-0.05	2.0							
15	K	1	2								
16	K1	ROUTING AT NUMBER 2 DAM									
17	Y			1	1						
18	Y1	1									
19	\$A	0.	6.	10.1	29.4			31.			
20	\$E1049.4		1064.9	1080.	1100.						
21	\$S1064.9		41	2.65	1.5						
22	\$D1069.2		2.65	1.5	300						
23	\$L	30.	275.	320.	324.						
24	\$V1069.2		1070.	1072.	1074.						
25	K	0	3								
26	K1	INFLOW HYDROGRAPH FOR NUMBER 1 DAM									
27	M	1	1	0.41							
28	P		19.4	102	120	130					
29	T										
30	W	0.79	0.4					1.0	0.05		
31	X	-1.5	-0.05	2.0							
32	K	2	4								
33	K1	COMBINE OUTFLOW AT NO. 2 WITH RUNOFF AT NO. 1									
34	K	1	5								
35	K1	ROUTE COMBINED FLOWS AT NO. 1 DAM									
36	Y			1	1						
37	Y1	1									
38	Y4	1046.5	1047.23	1047.96	1048.69	1049.42	1050.15	1051.00	149.3	-1	
39	Y5	0.0	40.1	120.9	234.5	436.7	637.5	907.4	1051.5	1053.	
40	\$A	0.	11.9	13.8	43.2	55.			1084.9	1671.1	
41	\$E	1009.	1046.5	1060.	1080.	1100.					
42	\$S1046.5										
43	\$D1049.8		2.65	1.5	500						
44	\$L	30.	100.	550.	553.	556.	559.	562.			
45	\$V1049.8		1050.	1051.	1052.	1053.	1054.	1055.			
46	K	99									
47	A										
48	A										
49	A										
50	A										
51	A										

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	3
COMBINE 2 HYDROGRAPHS AT	4
ROUTE HYDROGRAPH TO	5
END OF NETWORK	

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE: 19 MAR 80
 RUN TIME: 10.30.40

NATIONAL PROGRAM FOR THE INSPECTION OF NON-FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF STAR JUNCTION NUMBER 1 DAM
 PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDERS METHOD

JOB SPECIFICATION
 NQ NHR NMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN
 300 0 5 0 0 0 0 0 -4 0
 JOPER NWT LROPT TRACE
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIO= 6 LRTIO= 1
 RTIOS= 1.00 0.50 0.40 0.30 0.20 0.10

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH FOR NUMBER 2 DAM

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME LSTAGE LAUTO
 1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA
 IHYDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 1 1 0.77 0.0 0.77 1.00 0.0 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.0 19.40 102.00 120.00 130.00 0.0 0.0 0.0

LOSS DATA
 LROPT STRKR DLTKR RTIOL ERAIN STRKS RTIOK STRIL CUSTL ALSMX RTIMP
 0 0.0 0.0 1.00 0.0 0.0 1.00 1.00 0.05 0.0 0.0

UNIT HYDROGRAPH DATA
 TP= 0.88 CP=0.40 NTA= 0

RECESSION DATA
 STRIQ= -1.50 GRCSN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 0.88 HOURS, CP= 0.40 VOL= 0.99

6.	22.	45.	73.	103.	136.	168.	193.	213.	226.
230.	223.	212.	202.	192.	183.	174.	165.	157.	149.
142.	135.	128.	122.	116.	110.	105.	100.	95.	90.
86.	82.	78.	74.	70.	67.	63.	60.	57.	54.
52.	49.	47.	45.	42.	40.	38.	36.	35.	33.
31.	30.	28.	27.	26.	24.	23.	22.	21.	20.
19.	18.	17.	16.	15.	15.	14.	13.	13.	12.
11.	11.	10.	10.	9.	9.	8.	8.	8.	7.
7.	7.	6.	6.	6.	5.	5.	5.	5.	4.
4.	4.	4.	4.	3.	3.	3.	3.	3.	3.

0
 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 25.22 23.34 1.88 136911.
 (641.)(593.)(48.)(3876.89)

HYDROGRAPH ROUTING

ROUTING AT NUMBER 2 DAM

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	LAUTO
	2	1	0	0	0	0	1	0	0
	ROUTING DATA								
CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR	
0.0	0.0	0.0	1	1	0	0		0	
	NSIPS	NSIDL	LAG	AMSKK	X	TSK	STORA	ISPRAT	
	1	0	0	0.0	0.0	0.0	31.	0	
SURFACE AREA=	0.	6.	10.	29.					
CAPACITY=	0.	31.	151.	529.					
ELEVATION=	1049.	1065.	1080.	1100.					
	CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL	
	1064.9	41.0	2.6	1.5	0.0	0.0	0.0	0.0	

	DAM DATA		
	TOPEL	COQD	EXPD
	1069.2	2.6	1.5
			DAMWID
			300.

CREST LENGTH AT OR BELOW ELEVATION	30.	275.	320.	324.
	1069.2	1070.0	1072.0	1074.0
PEAK OUTFLOW IS	2256.	AT TIME	16.50 HOURS	
PEAK OUTFLOW IS	1090.	AT TIME	16.67 HOURS	
PEAK OUTFLOW IS	860.	AT TIME	16.75 HOURS	
PEAK OUTFLOW IS	641.	AT TIME	16.75 HOURS	
PEAK OUTFLOW IS	424.	AT TIME	16.83 HOURS	
PEAK OUTFLOW IS	208.	AT TIME	16.92 HOURS	

***** SUB-AREA RUNOFF COMPUTATION *****

INFLOW HYDROGRAPH FOR NUMBER 1 DAM

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	LAUTO
	3	0	0	0	0	0	1	0	0
	HYDROGRAPH DATA								
IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.41	0.0	0.41	1.00	0.0	0	0	0
	PRECIP DATA								
	SPFE	PMS	R6	R12	R24	R48	R72	R96	
	0.0	19.40	102.00	120.00	130.00	0.0	0.0	0.0	
	LOSS DATA								
LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTICK	STRTL	CNSTL	ALSMX
0	0.0	0.0	1.00	0.0	0.0	1.00	1.00	0.05	0.0
	UNIT HYDROGRAPH DATA								
	TP=	0.79	CP=	0.40	NTA=	0			
	RECESSION DATA								
	STRKQ=	-1.50	ORCSN=	-0.05	RTIOR=	2.00			

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 0.79 HOURS, CP= 0.40 VOL= 1.00

4.	15.	31.	50.	71.	92.	110.	124.	133.	136.
131.	124.	118.	111.	105.	99.	94.	89.	84.	79.
75.	71.	67.	63.	60.	57.	54.	51.	48.	45.
43.	40.	38.	36.	34.	32.	31.	29.	27.	26.
24.	23.	22.	21.	19.	18.	17.	16.	16.	15.
14.	13.	12.	12.	11.	10.	10.	9.	9.	8.
8.	7.	7.	7.	6.	6.	6.	5.	5.	5.
5.	4.	4.	4.	4.	3.	3.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
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SUM 25.22 23.34 1.88 73256.
(641.)(593.)(48.)(2074.38)

COMBINE HYDROGRAPHS

COMBINE OUTFLOW AT NO. 2 WITH RUNOFF AT NO. 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	2	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTE COMBINED FLOWS AT NO. 1 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0
ROUTING DATA								
CLOSS	CLOSS	AVG	IRIS	ISAME	IOPT	IPMP	LSTR	
0.0	0.0	0.0	1	1	0	0	0	
NSTPS	NSTDL	LAG	AMSK	X	TSK	STORA	ISPRAT	
1	0	0	0.0	0.0	0.0	149.	-1	

STAGE	1046.50	1047.23	1047.96	1048.69	1049.42	1050.15	1051.00	1051.50	1053.00
FLOW	0.0	40.10	120.90	234.50	436.70	637.50	907.40	1084.90	1671.10
SURFACE AREA=	0.	12.	14.	43.	55.				
CAPACITY=	0.	149.	322.	865.	1844.				
ELEVATION=	1009.	1047.	1060.	1080.	1100.				

CREL	SPWID	COGW	EXPW	ELEVL	COQL	CAREA	EXPL
1046.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA			
TOPEL	COQD	EXPD	DAMWID
1049.8	2.6	1.5	500.

CREST LENGTH AT OR BELOW ELEVATION	30.	100.	550.	553.	556.	559.	562.
	1049.8	1050.0	1051.0	1052.0	1053.0	1054.0	1055.0

PEAK OUTFLOW IS 3508. AT TIME 16.50 HOURS

PEAK OUTFLOW IS 1686. AT TIME 16.67 HOURS

PEAK OUTFLOW IS 1331. AT TIME 16.75 HOURS

PEAK OUTFLOW IS 985. AT TIME 16.83 HOURS

PEAK OUTFLOW IS 614. AT TIME 17.25 HOURS

PEAK OUTFLOW IS 289. AT TIME 17.58 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

FLows IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)

AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
				1.00	0.50	0.40	0.30	0.20	0.10
HYDROGRAPH AT	1	0.77	1	2263.	1131.	905.	679.	453.	226.
	(	1.99)	(	64.07)	32.04)	25.63)	19.22)	12.81)	6.41)
ROUTED TO	2	0.77	1	2256.	1090.	860.	641.	424.	208.
	(	1.99)	(	63.88)	30.87)	24.35)	18.15)	12.00)	5.88)
HYDROGRAPH AT	3	0.41	1	1277.	638.	511.	383.	255.	128.
	(	1.06)	(	36.16)	18.08)	14.46)	10.85)	7.23)	3.62)
2 COMBINED	4	1.18	1	3512.	1695.	1337.	998.	659.	323.
	(	3.06)	(	99.45)	47.99)	37.87)	28.26)	18.67)	9.15)
ROUTED TO	5	1.18	1	3508.	1686.	1331.	985.	614.	289.
	(	3.06)	(	99.33)	47.75)	37.68)	27.89)	17.40)	8.18)

SUMMARY OF DAM SAFETY ANALYSIS

STAR JUNCTION NO. 2. DAM

PLAN 1

ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
STORAGE	1064.90	1064.90	1069.20
OUTFLOW	31.	31.	59.
	0.	0.	969.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1070.52	1.32	69.	2256.	4.33	16.50	0.0
0.50	1069.47	0.27	61.	1090.	1.08	16.67	0.0
0.40	1068.87	0.0	57.	860.	0.0	16.75	0.0
0.30	1068.17	0.0	52.	641.	0.0	16.75	0.0
0.20	1067.38	0.0	47.	424.	0.0	16.83	0.0
0.10	1066.44	0.0	41.	208.	0.0	16.92	0.0

SUMMARY OF DAM SAFETY ANALYSIS

STAR JUNCTION NO. 1 DAM

PLAN 1

ELEVATION
STORAGE
OUTFLOW

INITIAL VALUE
1046.54
149.
2.

SPILLWAY CREST
1046.50
149.
0.

TOP OF DAM
1049.80
189.
541.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1051.62	1.82	212.	3508.	8.42	16.50	0.0
0.50	1050.95	1.15	203.	1686.	5.75	16.67	0.0
0.40	1050.75	0.95	201.	1331.	4.67	16.75	0.0
0.30	1050.49	0.69	197.	985.	3.42	16.83	0.0
0.20	1050.01	0.21	191.	614.	1.67	17.25	0.0
0.10	1048.89	0.0	178.	289.	0.0	17.58	0.0

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

1	A1	NATIONAL PROGRAM FOR THE INSPECTION OF NON-FEDERAL DAMS									
2	A1	HYDROLOGIC AND HYDRAULIC ANALYSIS OF STAR JUNCTION NUMBER 1 DAM									
3	A1	PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDERS METHOD									
4	B	300	0	5	0	0	0	0	0	-4	0
5	B1	5									
6	J	2	1	1							
7	J1	0.45									
8	K	0	1						1		
9	K1	INFLOW HYDROGRAPH FOR NUMBER 2 DAM									
10	M	1	1	0.77			1			1	
11	P		19.4	102	120	130					
12	T								1.0	0.05	
13	W	0.88	0.40								
14	X	-1.5	-0.05	2.0							
15	K	1	2						1		
16	K1	ROUTING AT NUMBER 2 DAM									
17	Y				1	1					
18	Y1	1							31.		
19	\$A	0.	6.	10.1	29.4						
20	\$E1049.4	1064.9	1080.	1100.							
21	\$S1064.9	41	2.65	1.5							
22	\$D1069.2	2.65	1.5	300							
23	\$L	30.	275.	320.	324.						
24	\$V1069.2	1070.	1072.	1074.							
25	K	0	3						1		
26	K1	INFLOW HYDROGRAPH FOR NUMBER 1 DAM									
27	M	1	1	0.41			1			1	
28	P		19.4	102	120	130					
29	T								1.0	0.05	
30	W	0.79	0.4								
31	X	-1.5	-0.05	2.0							
32	K	2	4						1		
33	K1	COMBINE OUTFLOW AT NO. 2 WITH RUNOFF AT NO. 1									
34	K	1	5						1		
35	K1	ROUTE COMBINED FLOWS AT NO. 1 DAM									
36	Y				1	1					
37	Y1	1							149.3	-1	
38	Y4	1046.5	1047.23	1047.96	1048.69	1049.42	1050.15	1051.00	1051.5	1053.	
39	Y5	0.0	40.1	120.9	234.5	436.7	637.5	907.4	1084.9	1671.1	
40	\$A	0.	11.9	13.8	43.2	55.					
41	\$E	1009.	1046.5	1060.	1080.	1100.					
42	\$S1046.5										
43	\$D1049.8	2.65	1.5	500							
44	\$L	30.	100.	550.	553.	556.	559.	562.			
45	\$V1049.8	1050.	1051.	1052.	1053.	1054.	1055.				
46	\$B	100.	0.5	1014.8	1.0	1046.5	1050.8				
47	\$B	100.	0.5	1014.8	1.0	1046.5	1052.0				
48	K	1	6						1		
49	K1	MOD PULS ROUTING FROM DAM TO SECTION SIX									
50	Y				1	1					
51	Y1	1									
52	Y6	.05	.03	.07	995.	1200.	900.	.057			
53	Y7	0.0	1200.	500.	1100.	1000.	1003.	1002.	995.	1012.	995.
54	Y7	1014.	1003.	2264.	1100.	3514.	1200.				
55	K	1	7						1		
56	K1	MOD PULS ROUTING FROM SECTION THREE TO SECTION SEVEN									
57	Y				1	1					
58	Y1	1									
59	Y6	.07	.04	.07	937.	1020.	8500.	.0068			
60	Y7	0.0	1020.	800.	960.	1000.	945.	1001.	937.	1009.	937.
61	Y7	1010.	945.	2400.	1000.	3010.	1020.				
62	K	99									
63	A										
64	A										
65	A										
66	A										
67	A										

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	3
COMBINE 2 HYDROGRAPHS AT	4
ROUTE HYDROGRAPH TO	5
ROUTE HYDROGRAPH TO	6
ROUTE HYDROGRAPH TO	7
END OF NETWORK	

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE: 12 MAR 80
 RUN TIME: 13.49.18

NATIONAL PROGRAM FOR THE INSPECTION OF NON-FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF STAR JUNCTION NUMBER 1 DAM
 PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDERS METHOD

JOB SPECIFICATION
 NQ NHR NMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN
 300 0 5 0 0 0 0 0 4 0
 JOPER NWT LROPT TRACE
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 2 NRTIO= 1 LRTIO= 1
 RTIOS= 0.45

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH FOR NUMBER 2 DAM

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO
 1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA
 IHYDG IUBG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 1 1 0.77 0.0 0.77 1.00 0.0 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.0 19.40 102.00 120.00 130.00 0.0 0.0 0.0

LOSS DATA
 LROPT STRKR DLTKR RTIOL ERAIN STRKS RTIOK STRIL CNSTL ALSMX RTIMP
 0 0.0 0.0 1.00 0.0 0.0 1.00 1.00 0.05 0.0 0.0

UNIT HYDROGRAPH DATA
 TP= 0.88 CP=0.40 NTA= 0

RECESSION DATA
 STRIQ= -1.50 GRCSN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 0.88 HOURS, CP= 0.40 VOL= 0.99

6.	22.	45.	73.	103.	136.	168.	193.	213.	226.
230.	223.	212.	202.	192.	183.	174.	165.	157.	149.
142.	135.	128.	122.	116.	110.	105.	100.	95.	90.
86.	82.	78.	74.	70.	67.	63.	60.	57.	54.
52.	49.	47.	45.	42.	40.	38.	36.	35.	33.
31.	30.	28.	27.	26.	24.	23.	22.	21.	20.
19.	18.	17.	16.	15.	15.	14.	13.	13.	12.
11.	11.	10.	10.	9.	9.	8.	8.	8.	7.
7.	7.	6.	6.	6.	5.	5.	5.	5.	4.
4.	4.	4.	4.	3.	3.	3.	3.	3.	3.

0
 MO.DA HR.MN PERIOD RAIN EXCS LOSS END-OF-PERIOD FLOW
 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 25.22 23.34 1.88 136911.
 (641.)(593.)(48.)(3876.89)

HYDROGRAPH ROUTING

ROUTING AT NUMBER 2 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSTPS	NSTD	LAG	AMSK	X	TSK	STOR	ISPRAT
1	0	0	0.0	0.0	0.0	31.	0

SURFACE AREA=	0.	6.	10.	29.
CAPACITY=	0.	31.	151.	529.
ELEVATION=	1049.	1065.	1080.	1100.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1064.9	41.0	2.6	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1069.2	2.6	1.5	300.

CREST LENGTH AT OR BELOW ELEVATION	30.	275.	320.	324.
	1069.2	1070.0	1072.0	1074.0

PEAK OUTFLOW IS 969. AT TIME 16.75 HOURS

PEAK OUTFLOW IS 969. AT TIME 16.75 HOURS

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH FOR NUMBER 1 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.41	0.0	0.41	1.00	0.0	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	19.40	102.00	120.00	130.00	0.0	0.0	0.0

LOSS DATA

LROPT	STKR	DLTKR	RTIOL	ERAIN	STKRS	RTIOK	STRIK	CNSTL	ALSMX	RTIMP
0	0.0	0.0	1.00	0.0	0.0	1.00	1.00	0.05	0.0	0.0

UNIT HYDROGRAPH DATA

TP= 0.79 CP=0.40 NTA= 0

RECESSION DATA

STRQ= -1.50 QRCN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 0.79 HOURS, CP= 0.40 VOL= 1.00

4.	15.	31.	50.	71.	92.	110.	124.	133.	136.
131.	124.	118.	111.	105.	99.	94.	89.	84.	79.
75.	71.	67.	63.	60.	57.	54.	51.	48.	45.
43.	40.	38.	36.	34.	32.	31.	29.	27.	26.
24.	23.	22.	21.	19.	18.	17.	16.	16.	15.
14.	13.	12.	12.	11.	10.	10.	9.	9.	8.
8.	7.	7.	7.	6.	6.	6.	5.	5.	5.
5.	4.	4.	4.	4.	3.	3.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

0
MO.DA HR.MN PERIOD RAIN EXCS LOSS END-OF-PERIOD FLOW
COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 25.22 23.34 1.88 73256.
(641.)(593.)(48.)(2074.38)

COMBINE HYDROGRAPHS

COMBINE OUTFLOW AT NO. 2 WITH RUNOFF AT NO. 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	2	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTE COMBINED FLOWS AT NO. 1 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSTPS	NSIDL	LAG	AMSK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	149.	-1

STAGE	1046.50	1047.23	1047.96	1048.69	1049.42	1050.15	1051.00	1051.50	1053.00
FLOW	0.0	40.10	120.90	234.50	436.70	637.50	907.40	1084.90	1671.10
SURFACE AREA=	0.	12.	14.	43.	55.				
CAPACITY=	0.	149.	322.	865.	1844.				
ELEVATION=	1009.	1047.	1060.	1080.	1100.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1046.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1049.8	2.6	1.5	500.

CREST LENGTH AT OR BELOW ELEVATION	30.	100.	550.	553.	556.	559.	562.
	1049.8	1050.0	1051.0	1052.0	1053.0	1054.0	1055.0

DAM BREACH DATA

BRWID	Z	ELEM	TFAIL	WSEL	FAILEL
100.	0.50	1014.80	1.00	1046.50	1050.80

BEGIN DAM FAILURE AT 16.42 HOURS

PEAK OUTFLOW IS 5850. AT TIME 16.79 HOURS

DAM BREACH DATA
 BRKID Z ELEM TFAIL WSEL FAILL
 100. 0.50 1014.80 1.00 1046.50 1052.00

PEAK OUTFLOW IS 1502. AT TIME 16.75 HOURS

 HYDROGRAPH ROUTING
 MOD PULS ROUTING FROM DAM TO SECTION THREE

ISTAQ	ICOMP	IBCON	ITAPE	JPLT	JPRT	INAME	ISTAGE	LAUTO
6	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
 ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSIPS	NSIDL	LAG	MSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	0.	0

NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELNVT	ELMAX	RLNTH	SEL
0.0500	0.0300	0.0700	995.0	1200.0	900.	0.05700

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.0	1200.00	500.00	1100.00	1000.00	1003.00	1002.00	995.00	1012.00	995.00
1014.00	1003.00	2264.00	1100.00	3514.00	1200.00				

STORAGE	0.0	4.24	40.27	119.70	242.52	408.73	618.33	871.33	1167.71	1507.49
	1890.61	2316.17	2783.82	3293.56	3845.39	4439.31	5075.32	5753.43	6473.62	7235.90

OUTFLOW	0.0	5236.57	50152.36	193289.00	479525.81	947153.25	1630669.00	2561965.00	3770975.00	5286081.00
	7138041.00	9357113.00	11956534.0	14959566.0	18388880.0	22266544.0	26614112.0	31452688.0	36802832.0	42684832.0

STAGE	995.00	1005.79	1016.58	1027.37	1038.16	1048.95	1059.74	1070.53	1081.31	1092.10
	1102.89	1113.68	1124.47	1135.26	1146.05	1156.84	1167.63	1178.42	1189.21	1200.00

FLOW	0.0	5236.57	50152.36	193289.00	479525.81	947153.25	1630669.00	2561965.00	3770975.00	5286081.00
	7138041.00	9357113.00	11956534.0	14959566.0	18388880.0	22266544.0	26614112.0	31452688.0	36802832.0	42684832.0

MAXIMUM STAGE IS 1005.9

MAXIMUM STAGE IS 998.1

 HYDROGRAPH ROUTING
 MOD PULS ROUTING FROM SECTION THREE TO SECTION FOUR

ISTAQ	ICOMP	IBCON	ITAPE	JPLT	JPRT	INAME	ISTAGE	LAUTO
7	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
 ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSIPS	NSIDL	LAG	MSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	0.	0

NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELWVT	ELMAX	FLNTH	SEL
0.0700	0.0400	0.0700	937.0	1020.0	8500.	0.00680

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.0	1020.00	800.00	960.00	1000.00	945.00	1001.00	937.00	1009.00	937.00
1010.00	945.00	2400.00	1000.00	3010.00	1020.00				

STORAGE	0.0	7.28	17.53	122.18	370.59	762.76	1298.68	1978.37	2801.81	3769.01
	4879.97	6134.68	7533.16	9075.39	10761.38	12594.39	14588.88	16746.60	19067.55	21551.70
OUTFLOW	0.0	195.24	548.73	2767.77	10426.67	26292.12	52695.44	91726.56	145311.56	215255.81
	303268.19	410980.75	539959.75	691715.44	867709.19	1065682.00	1288979.00	1542078.00	1826515.00	2143794.00
STAGE	937.00	941.37	945.74	950.11	954.47	958.84	963.21	967.58	971.95	976.32
	980.68	985.05	989.42	993.79	998.16	1002.53	1006.89	1011.26	1015.63	1020.00
FLOW	0.0	195.24	548.73	2767.77	10426.67	26292.12	52695.44	91726.56	145311.56	215255.81
	303268.19	410980.75	539959.75	691715.44	867709.19	1065682.00	1288979.00	1542078.00	1826515.00	2143794.00

MAXIMUM STAGE IS 950.7

MAXIMUM STAGE IS 947.3

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO	1	RATIOS APPLIED TO FLOWS
					0.45	
HYDROGRAPH AT	1	0.77	1	1018.		
	(	1.99)	(	28.83)(
			2	1018.		
			(	28.83)(
ROUTED TO	2	0.77	1	969.		
	(	1.99)	(	27.45)(
			2	969.		
			(	27.45)(
HYDROGRAPH AT	3	0.41	1	575.		
	(	1.06)	(	16.27)(
			2	575.		
			(	16.27)(
2 COMBINED	4	1.18	1	1508.		
	(	3.06)	(	42.71)(
			2	1508.		
			(	42.71)(
ROUTED TO	5	1.18	1	5788.		
	(	3.06)	(	163.90)(
			2	1502.		
			(	42.53)(
ROUTED TO	6	1.18	1	5789.		
	(	3.06)	(	163.91)(
			2	1502.		
			(	42.53)(
ROUTED TO	7	1.18	1	3763.		
	(	3.06)	(	106.55)(
			2	1362.		
			(	36.57)(

SUMMARY OF DAM SAFETY ANALYSIS

STAR JUNCTION NO. 2 DAM

PLAN 1			INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
	ELEVATION		1064.90	1064.90	1069.20			
	STORAGE		31.	31.	59.			
	OUTFLOW		0.	0.	969.			
	RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF	
	OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	FAILURE	
	PMF	W.S.ELEV	OVER DAM	AC-FT	HOURS	HOURS	HOURS	
	0.45	1069.20	0.00	59.	969.	0.08	16.75	0.0
PLAN 2			INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
	ELEVATION		1064.90	1064.90	1069.20			
	STORAGE		31.	31.	59.			
	OUTFLOW		0.	0.	969.			
	RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF	
	OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	FAILURE	
	PMF	W.S.ELEV	OVER DAM	AC-FT	HOURS	HOURS	HOURS	
	0.45	1069.20	0.00	59.	969.	0.08	16.75	0.0

SUMMARY OF DAM SAFETY ANALYSIS

STAR JUNCTION NO. 1 DAM

PLAN 1			INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
	ELEVATION		1046.50	1046.50	1049.80			
	STORAGE		149.	149.	189.			
	OUTFLOW		0.	0.	541.			
	RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF	
	OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	FAILURE	
	PMF	W.S.ELEV	OVER DAM	AC-FT	HOURS	HOURS	HOURS	
	0.45	1050.80	1.00	201.	5850.	1.71	16.79	16.42
PLAN 2			INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
	ELEVATION		1046.50	1046.50	1049.80			
	STORAGE		149.	149.	189.			
	OUTFLOW		0.	0.	541.			
	RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF	
	OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	FAILURE	
	PMF	W.S.ELEV	OVER DAM	AC-FT	HOURS	HOURS	HOURS	
	0.45	1050.85	1.05	202.	1502.	5.25	16.75	0.0

PLAN 1	STATION		6
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.45	5789.	1005.9	16.83

PLAN 2	STATION		6
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.45	1502.	998.1	16.75

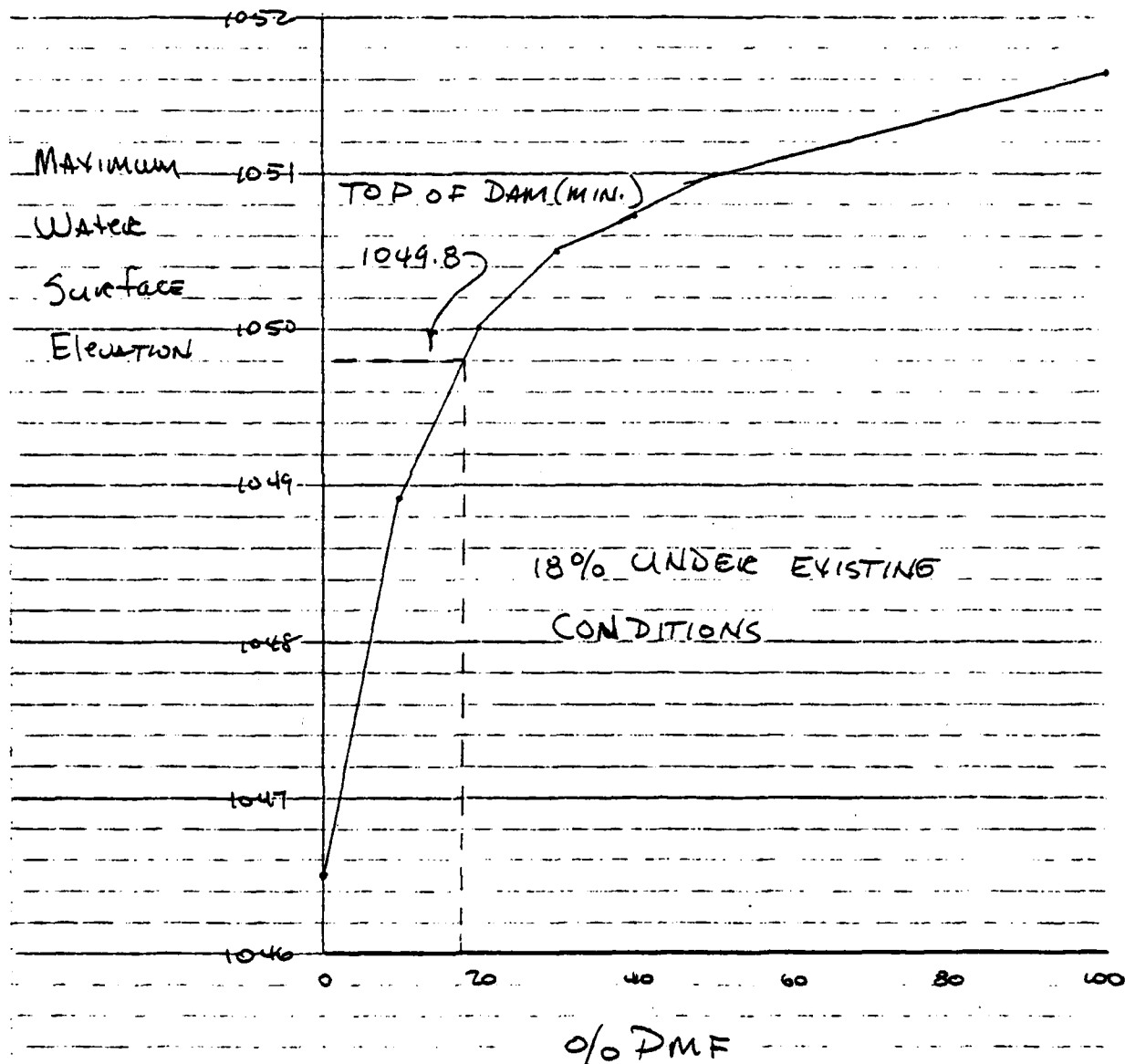
PLAN 1	STATION		7
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.45	3763.	950.7	17.08

PLAN 2	STATION		7
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.45	1362.	947.3	17.42

ACKENHEIL & ASSOCIATES
GEO Systems, Inc.
1000 Banksville Road
PITTSBURGH, PA. 15216
(412) 531-7111

Sheet _____ of _____
Job Star Junction No. 1 Dam Job No. 79153B
Subject SPILLWAY/RESERVOIR CAPACITY RATING CURVE
Made By JDH Date 3/20/80 Checked SCM Date 3/20/80

HYDROLOGICAL PERFORMANCE PLOT

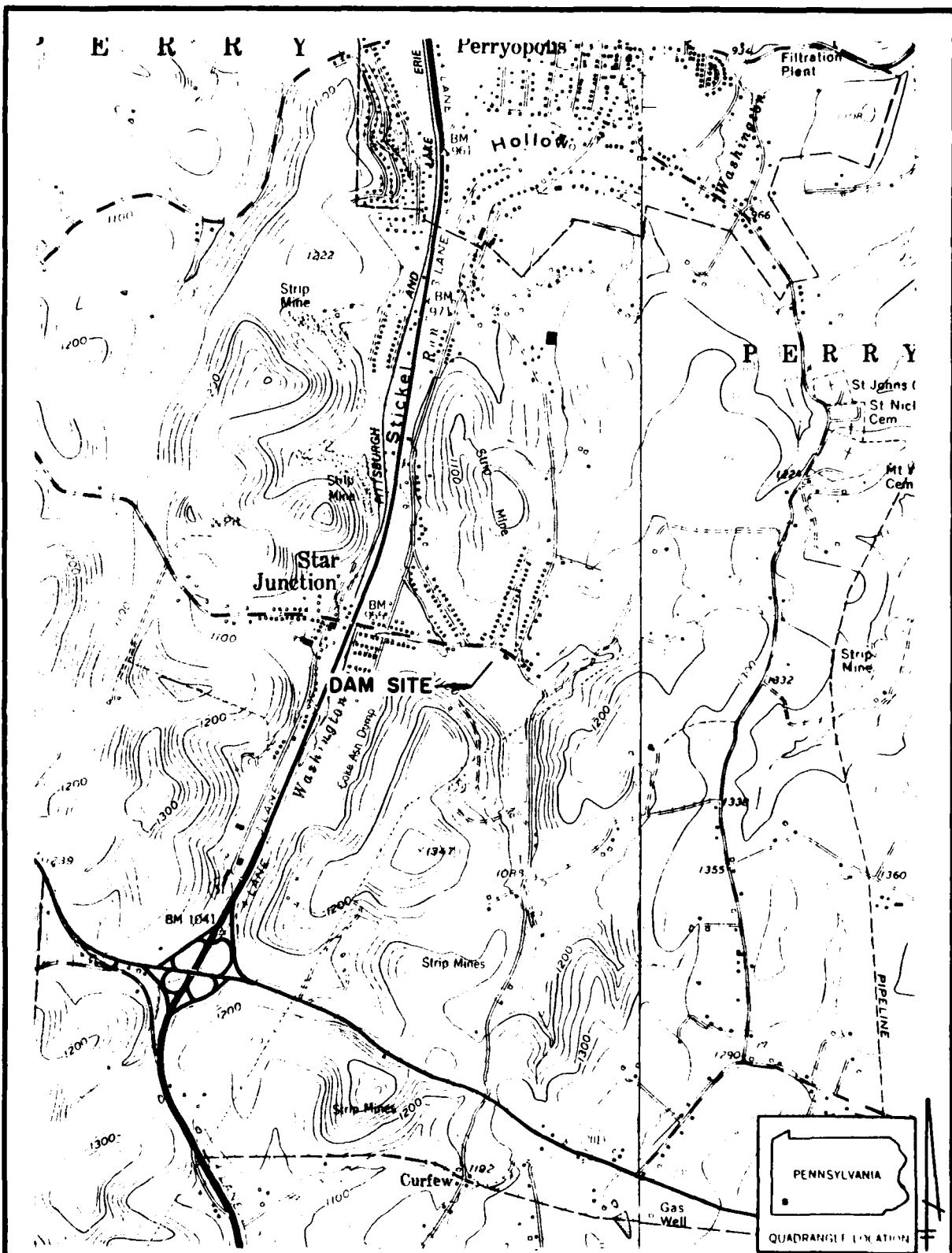


APPENDIX E

PLATES

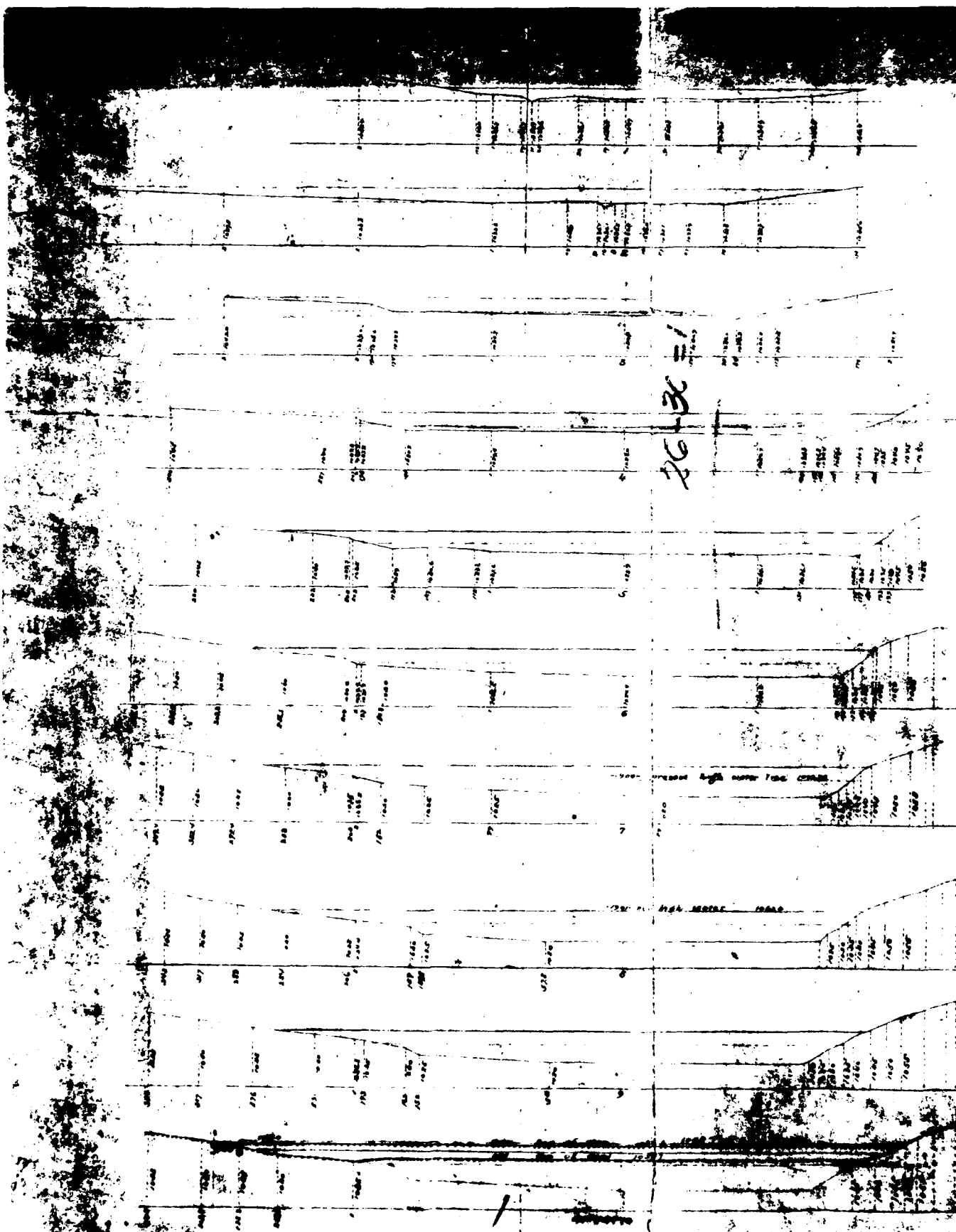
LIST OF PLATES

- | | |
|-----------|---|
| Plate I | Regional Vicinity Map |
| Plate II | Plan and Cross-Sections of No.1 Reservoir |
| Plate III | No. 1 Reservoir Spillway |
| Plate IV | No. 1 Reservoir through Slip on Outer
Slope of Dam |



FAYETTE CITY and DAWSON U.S.G.S. 7 1/2 min. QUADRANGLES

DATE: MARCH 1980		STAR JUNCTION No.1 DAM NATIONAL DAM INSPECTION PROGRAM		REGIONAL VICINITY MAP
SCALE: 1" = 2000'				
DR: JF	CK: JEB	A. C. ACKENHEIL & ASSOCIATES, INC. CONSULTING ENGINEERS PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.		
PLATE I				



Plan and cross sections of R.R.

W.C. & Co. New Junction.

PAID BY CO. PENNA.



AD-A085 238

ACKENWEIL AND ASSOCIATES INC PITTSBURGH PA
NATIONAL DAM INSPECTION PROGRAM, STAR JUNCTION NUMBER 1 DAM (ND--ETC(U)
APR 80 W MCCORMICK
DACW31-80-C-0026
NL

F/6 13/13

UNCLASSIFIED

2 IN 2
2 IN 2
2 IN 2



END
DATE
FILMED
7-80
DTIC

2

Reservoir

Embankment

Concrete

Gravel

Spillway

Top of Embankment

Plate III

Spillway

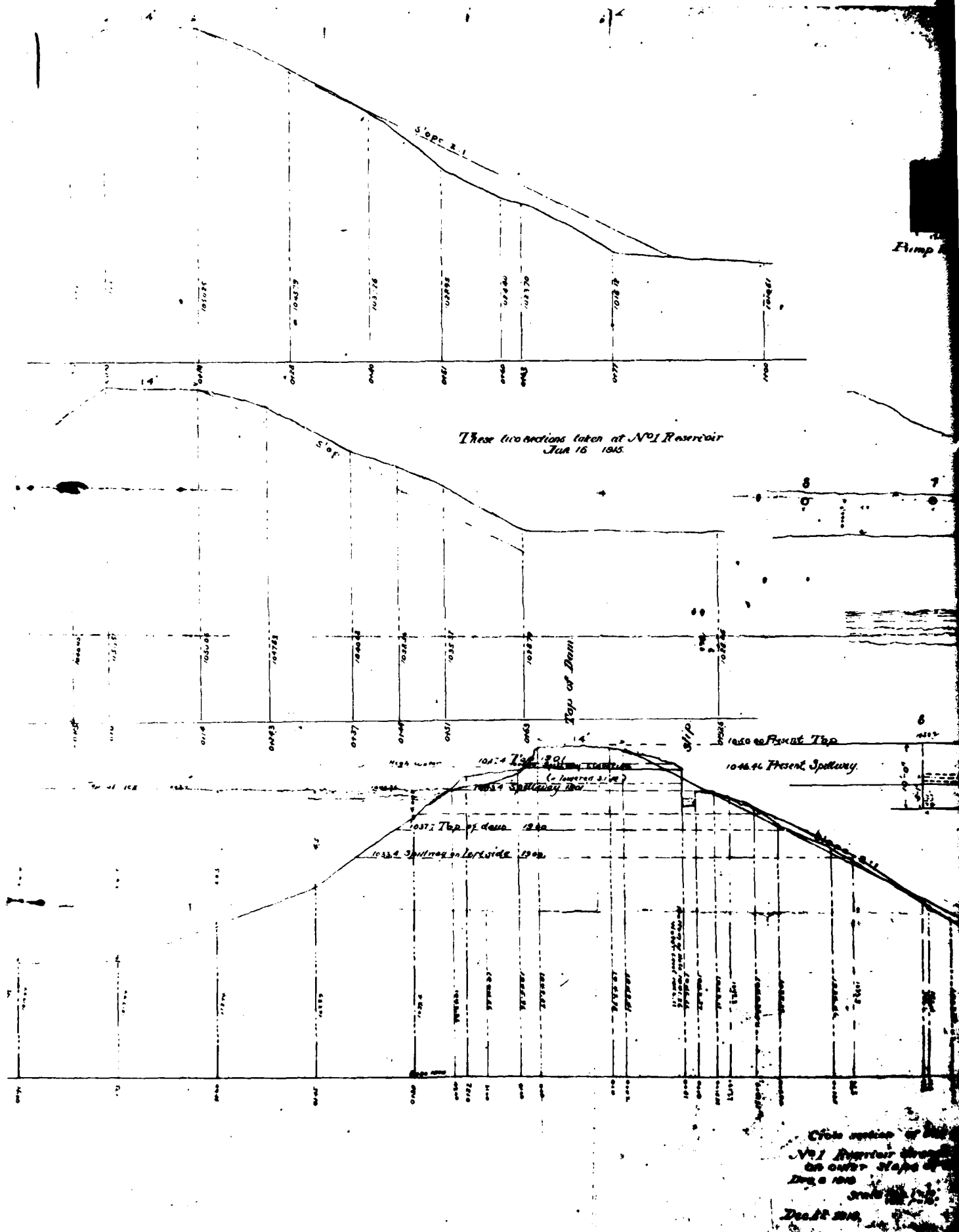
Concrete

Gravel

Embankment

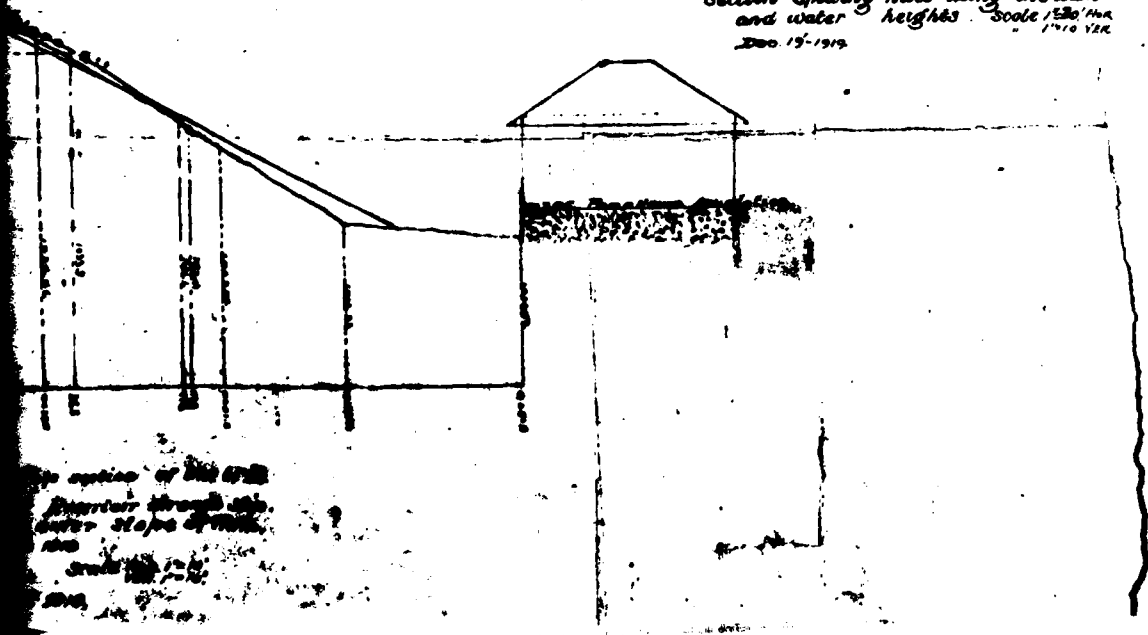
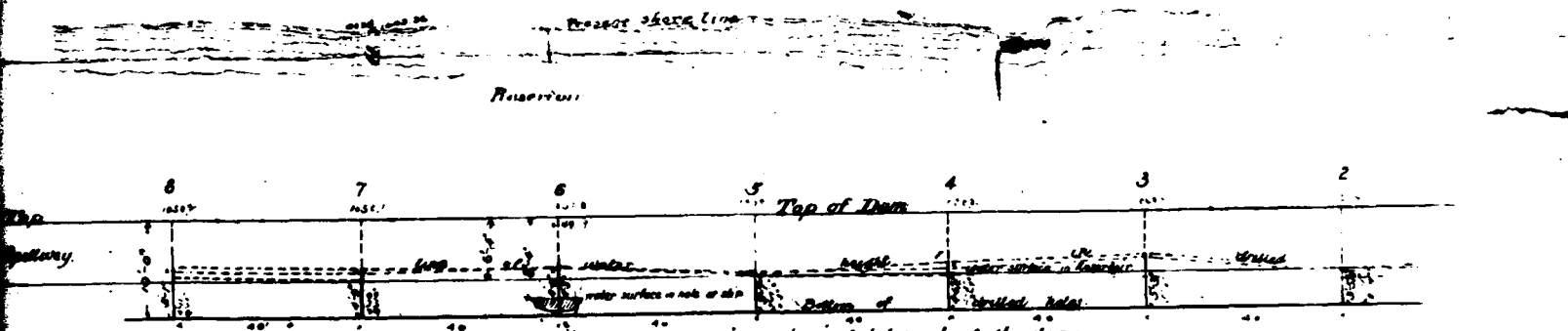
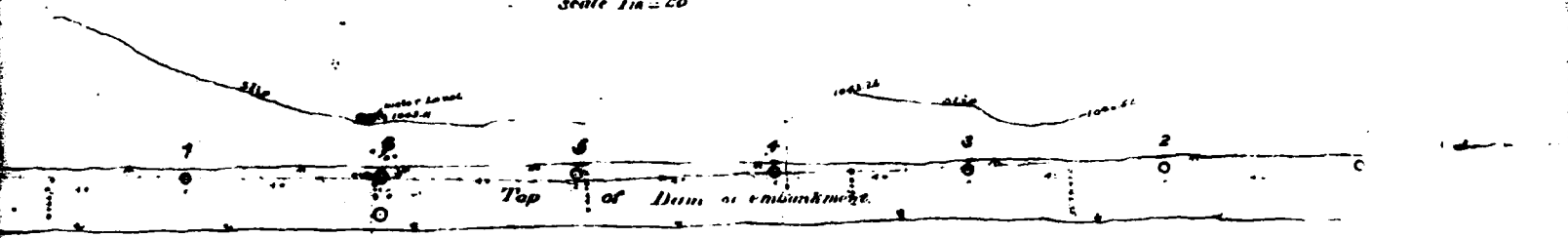
Top of Embankment

*Springfield
Company
Piano
M. B. B. Co.*



Pump house.

Plan View
Scale 1 in = 50'



No.	Height
1	1000.0
2	1000.0
3	1000.0
4	1000.0
5	1000.0
6	1000.0
7	1000.0
8	1000.0

APPENDIX F

GEOLOGY

GEOLOGY

Geomorphology

Star Junction No. 1 Dam is located within the Pittsburgh Plateau section of the Appalachian Plateau physiographic province. This area is characterized as a mature plateau of nearly flat lying sedimentary rocks dissected by numerous small streams forming in many places steep-sided valleys. No. 1 dam lies on an unnamed tributary of Washington Run immediately north and downstream of No. 2 Dam, just east of Star Junction, Pennsylvania.

Structure

General: Star Junction No. 1 Dam is located approximately equidistant from the Fayette anticline to the east and the Lambert syncline to the west. Both of these structural features trend NE-SW. According to estimates based on the "Coal and Surface Structure Map of Fayette County, Pennsylvania", the strata in the immediate vicinity of the dam strike at N9°E and dip at 320 feet/mile (3.5°) to the west.

Faults: No observations were made that would indicate faulting in the rocks outcropping around the dam site. In general, only a few evidences of faulting have been observed in all of Fayette County.

Stratigraphy

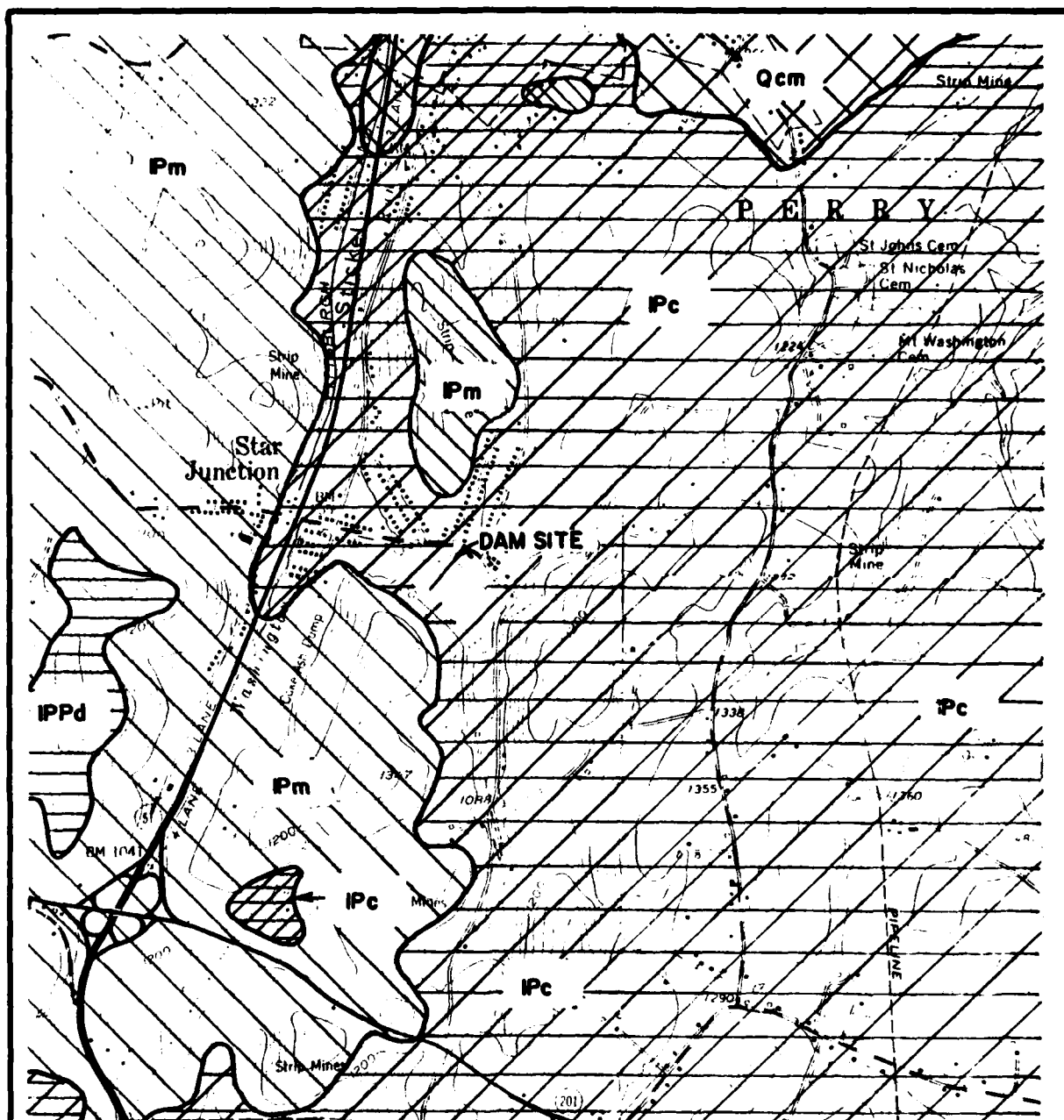
General: The rocks exposed in the immediate area of No. 1 Dam are part of the Conemaugh Group of Pennsylvanian age, and include primarily the uppermost portion of the Casselman Formation. The Pittsburgh Coal Seam, which stratigraphically marks the top of the Conemaugh Group and the base of the Monongahela Group, is estimated to outcrop on the west hillside about 110 feet above the dam.

The following rock units are present in the immediate vicinity of Star Junction No. 1 Dam:

Connellsville Member: The Connellsville Member of the Casselman Formation is exposed in the discharge channel downstream of the spillway and along the right abutment. It is characterized as a green brown, thin to medium

bedded sandstone or silty sandstone. It is approximately 65 feet thick.

Little Pittsburgh Member: The Little Pittsburgh Member of the Casselman Formation occurs immediately above the Connellsville and is the uppermost member of the Conemaugh Group. This heterogeneous formation is composed of a cyclic sequence of limestone, coal beds, and shaley sandstone. Its thickness averages 20 feet.



FAYETTE CITY AND DAWSON QUADRANGLES, FAYETTE COUNTY, PENNSYLVANIA

SCALE:  1:24000

CONTOUR INTERVAL 20 FT. DATUM IS MEAN SEA LEVEL

——— FORMATION CONTACT

——— CONTACT BETWEEN CONEMAUGH & MONONGAHELA

DATA OBTAINED FROM PENNSYLVANIA TOPOGRAPHIC AND GEOLOGIC SURVEY, GEOLOGIC MAP OF FAYETTE COUNTY, PENNSYLVANIA, 1940 and COAL AND SURFACE STRUCTURE MAP OF FAYETTE COUNTY, PENNSYLVANIA, 1940

DATE: MARCH 1980

SCALE: AS SHOWN

DR: PT

CK: JEB

STAR JUNCTION No. 1 DAM
NATIONAL DAM INSPECTION PROGRAM

A. C. ACKENHEIL & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.

GEOLOGIC
MAP

AGE	SCORE	FEET	COLUMNAR SECTION	PROMINENT BEDS
QUATERNARY				PLEISTOCENE GLACIAL OUTWASH, RIVER TERRACE DEPOSITS AND ALLUVIUM
PERMIAN				
	DUNLAP (PP-1)	GREENE (P-1)		UPPER WASHINGTON LIMESTONE
		WASHINGTON (PP-2)		WASHINGTON COAL
		WAYNESBURG (PP-3)		WAYNESBURG SANDSTONE
				WAYNESBURG COAL
		UNIONTOWN (PP-4)		UNIONTOWN SANDSTONE
				UNIONTOWN COAL
		BENWOOD (PP-5)		BENWOOD LIMESTONE
		SEWICKLEY (PP-6)		SEWICKLEY COAL
		PITTSBURGH (PP-7)		PITTSBURGH SANDSTONE
				PITTSBURGH COAL
		CONNELLVILLE (PP-8)		CONNELLVILLE SANDSTONE
		MORGANTOWN (PP-9)		MORGANTOWN SANDSTONE
		AMES (PP-10)		AMES LIMESTONE
		PITTSBURGH RED BEDS		PITTSBURGH RED BEDS
		SALTSBURG (PP-11)		SALTSBURG SANDSTONE
		MANORING (PP-12)		MANORING SANDSTONE
		UPPER FREEPORT (PP-13)		UPPER FREEPORT COAL
		UPPER KITTANNING (PP-14)		UPPER KITTANNING COAL
		WORTHINGTON (PP-15)		WORTHINGTON SANDSTONE
		LOWER KITTANNING (PP-16)		LOWER KITTANNING COAL
		HOMEROCK (PP-17)		HOMEROCK SANDSTONE
		MERCER (PP-18)		MERCER SANDSTONE, SHALE & COAL
		CONNOQUENESSING (PP-19)		CONNOQUENESSING SANDSTONE
MISSISSIPPIAN				
		BURGON (PP-20)		BURGON SANDSTONE
		CUYAHOGA (PP-21)		CUYAHOGA SHALE
		BEREA (PP-22)		BEREA SANDSTONE

DATE: MARCH 1980

SCALE: NONE

DR: JF

CK: JEB

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PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.

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